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EDITORIAL

he New Year. The year 1941 has dawned none too bright on an py world. Three out of five continets are witnessing the ravages of a tating war. Destruction of life and property continues unabated. ilture and trade are in the throes of a depression. Science and Industry, hose that are of direct consequence to the prosecution of the war, are g ruinously. Restricted food distribution has created slumps in pro- g centres and distress in consuming areas. Despite these maladjust- inevitable in a period of crisis, the outlook for 1941 is brighter and cheery than what it was in 1940. The *Madras Agricultural Journal* on its twentyninth year in an atmosphere of hope and faith. Increases cost of production and distribution of the *Journal* have been counter- ed by increased patronage from our *clientele*. We thank our members, ibers, contributors, advertisers and readers for their continued t and wish them all a happy and prosperous New Year.

roundnut Trade. We had occasion to advert in a previous issue of urnal to the sad plight of the groundnut growers in our Province and oundnut trade as affecting India. As a result of the active interest by the Hon. Sir A. Ramaswami Mudaliar, the Commerce Member, overnment of India in consultation with the Food Ministry in England he minimum price of groundnuts at £ 10 per ton f. o. b. Indian ports works at Rs. 27—8 - 0 per candy of 531 lb. This has however not benefitted the growers as reports received from different parts indi- e existence of a great disparity in the prices now prevailing in the markets and the minimum price offered by the Food Ministry. Thus stress of the agriculturist and the small producer is profound and s unsolved. It is now learnt that an arrangement has been reached n the Food Ministry in London and the Government of India for g a fund for the benefit of the agriculturists from the proceeds of a of 25 shillings per ton from South Indian shipments. This fund is sed to be distributed to the growers on an acreage basis. We daresay me such action to relieve the distress of the groundnut growers is ly necessary to ease the feeling of despondency prevailing in the s. We are encouraged by the recent press reports that the Govern- of Madras and some other Provincial and State Governments have l to foster the manufacture of products such as vegetable ghee, hes, lubricants and soaps from ground-nut oil. It is also understood e Government of India are in correspondence with the Provincial

Governments in this connection. It is well known that groundnuts cannot be stored long without deterioration and it would greatly benefit our growers if this scheme is put on hand expeditiously.

We would urge that the question of utilizing groundnuts in India itself is tackled on another front also. That the groundnut is a cheap source of protein and a valuable article of food is beyond doubt. How far and in what manner it can be included usefully in South Indian diets needs a careful study at the hands of our nutrition experts. Such an investigation coupled with effective propaganda will no doubt stimulate the consumption of groundnuts within our own country. Further the increased crushing of groundnuts would release large quantities of groundnut cake which is a very rich source of proteins for our cattle, besides its being a valuable manure particularly for sugarcane and paddy crops. The price of nitrogenous fertilizers has shot up prohibitively since the outbreak of the war and imports have dwindled. Oil cakes could well replace them now at a much cheaper rate.

We are glad that the recent conference of representatives of groundnut interests at Madras has focussed the attention of all concerned to the pitiable plight of our ryots and we hope that their sustained efforts would ere long afford the agriculturists the much needed relief.

An Agricultural Pests and Diseases Act for Bombay. The decision of the Bombay Government to enact a legislation on the lines of the Madras Agricultural Pests and Diseases Act of 1919 is a move which has not emanated too soon. Adequate control of insect pests and diseases is a matter of vital importance to the cultivator in India as elsewhere. In the matter of pests and diseases, the policy of Agricultural departments in India has been to bring to the door of the peasant cultivator the necessary knowledge about methods of control. With many pests and diseases this is all what is needed, since the adoption of the measures gives the cultivator relief, while failure to follow up demonstrable remedies does harm only to himself. But there is another important category of pests and diseases where the range of spread is not confined to the limited area of an individual holding. In such cases, the negligence on the part of the few would not only do harm to themselves but would render the efforts of their neighbours futile. The negligent and the unbelieving would thus become a danger to society so that the protection of the crops belonging to the many by compelling the few to fall in line with the rest, becomes a paramount duty of the state. The enactment of a piece of legislation making it incumbent on all cultivators in a specified tract to adopt a uniform procedure, is the only means of mitigating this evil. Failure to carry out the measures would authorise a state agency to enter the holding, carry out the operations and recover the cost from the delinquent. Wilful infringements of the regulations would also render him liable for prosecution. Legislation on these lines has worked successfully in Madras and her neighbouring states for well over two decades and we trust that Bombay will be no exception in deriving benefit from the contemplated enactment.

Studies in the Barnyard Millet—*Echinochloa colona* var. *frumentacea*, C. E. C. Fischer.

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The Barnyard millet, known in Tamil as *Kuthiraivali* (=horse-tail), is one of the less important millets of the Madras Presidency. Except in certain restricted tracts its importance as a food crop in India is not much. In view of the fact that it forms a good famine crop and also comes to the rescue of very poor cultivators, some of its characters were studied at the Millets Breeding Station and are presented below:—

This plant is considered to have been first brought into cultivation in India. That it has been grown all over India since very remote times is seen by the fact that it has a name in Sanskrit, as well as in every one of the other Indian languages.

Werth (1937) mentions this plant occurring as a weed of cultivation in the temperate and tropical zones of both hemispheres, particularly the Northern and that it is cultivated as a millet (as a poor man's millet) in India, China, Japan, Dutch India and in smaller quantities in Africa. In China and Japan particularly it is said to be used as a substitute crop when paddy fails.

Its composition is given by Church (1886) as follows:—

		In 100 parts.
Water	...	12·0
Albuminoids	...	8·4
Starch	...	72·5
Oil	...	3·0
Fibre	...	2·2
Ash	...	1·9

The nutrient ratio here is 1 : 9·5 and the nutrient value is 88.

This millet is used in India either boiled in water like rice, or parched or boiled with milk and sugar.

As a fodder it seems to have attracted greater attention especially in the U. S. A. Bressman and Fry (1932) consider this plant as the best late season feed, taking the place of maize in certain parts, which are unsuitable for maize. Thatcher (1900) gives the following composition of this plant as a forage crop.

Composition of feeding stuff at different stages of growth.

Feeding stuffs	Water	Protein	Albuminoids	Ether extracts	Nitrogen free extracts	Crude fibre	Ash
Millet: Heads just appearing	10·24	8·41	5·79	2·54	32·03	35·86	10·92
Headed out seeds near ripe.	10·47	6·12	4·49	1·52	43·33	29·10	9·41

He concludes that here the protein decreases rapidly while heading out and to obtain a fodder having as narrow a ratio of flesh-forming to fat-forming foods as possible the crop should be cut at as early a stage as it can be well cured. As a roughage it can be allowed to grow till seeds are formed.

Lindsey (1900) gives the following coefficients of digestibility of this plant: green, as hay and as silage with soybean, obtained with sheep.

Coefficients of digestibility of millet, millet hay etc.

	Dry matter	Protein	Fat	Nirogen free extracts	Crude fibre	Ash.
	%	%	%	%	%	%
Green millet, early to late bloom	71	69	63	72	73	64
Millet hay, full bloom	56·5	47·5	48	53.5	62	43·5
Millet and Soy bean silage	59	57	72	59	69	—
Corn and soy bean silage	69	65	82	75	65	—

He points out that when harvested early, in blossom, the fodder contains less nitrogen-free extract matter, more fibre or woody matter and rather more ash than corn fodder and so it must be cut when in blossom, to secure it in the most desirable condition for feeding.

On well-manured soils it gave 11,297 lbs. of straw and 66·7 bu. per acre and 12—15 tons per acre of green forage. Wood (1928) gives the yield of straw as 2,000 lbs. per acre, Mukerji (1915) records 800 lbs. and Mollison (1901) 1,500 lb. Watt (1889) states that the straw is used much in the Madras Presidency and Mysore as cattle fodder, though considered inferior to ragi as well as to paddy straw.

Kuthiravali is sown mostly as a rainfed crop. In the drier districts, it is grown as a subordinate crop to sorghum (Duthie and Fuller 1882) or maize (Watt l. c.) The plant can be grown either on light sandy soils (Duthie and Fuller. l. c.; Mollison. l. c.) with fair rainfall or in water-logged areas (Wood. l. c ; Watt. l. c.), such as lowlands or banks of rivers that often get submerged. Mukerji (l. c) reports that rough jungle land could be used. It withstands transplanting (Mollion l. c.) The crop requires little or no manuring.

The seed rate is generally 8 – 10 lbs. per acre and when sown with a drill about 6—8 lbs. per acre. Wood (l. c.) quotes 35 lbs. per acre. The July sown crop is harvested in October

In Punjab this plant is said to be ploughed into the soil as a green manure.

Systematics. Hooker (1897) brings this plant under the sub-section Echinochloa of the genus Panicum. He recognises two very closely allied species viz. *Panicum crusgalli*, Linn. and *Panicum colonum*, Linn. The cultivated species is regarded as a variety of *P. crusgalli*. In his species of *P. crusgalli*, Linn. he finds innumerable forms so that it became "impossible to find characters constant enough for their limitation". He finds that *P. colonum* Linn. exhibits a gradual transition into *P. crusgalli* and *vice versa*. The cultivated variety *furmentaceum* has been assigned to both. Cosson and Thwaites are reported having regarded *colonum* as a form of *crusgalli*.

Cook (1908) mentions that the *Panicum crusgalli* of Linnaeus does not occur in the Bombay Presidency. He considers the cultivated form as a variety of P. *stagnium*, Retz.—P. *stagnium*, Retz., var. *frumentacea*, Trinn. The species *crusgalli* has no ligule. P. *frumentaceum*, Roxb. and *Oplismenus frumentaceus* Dalz. and Gibs. are given as synonyms of P. *stagninum* var. *frumentacea*. He remarks that P. *colonum* is very similar to var. *frumentaceum*, Roxb. but a more slender plant with smaller spikelets.

Chevalier (1922) quotes the following synonyms for this plant: P. *frumentaceum* Roseb., P. *grossum*, L. P. *segetale*, Roxb., *Echinochloa frumentacea*, Link., *Oplismenus frumentaceus*, Kunth. P. *frumentaceum* is said to be a variety of P. *crusgalli*, L. It is considered by most authors that P. *frumentaceum* possesses characters intermediate between those of P. *crusgalli*, L. and P. *colonum*, L.

Bressman and Fry (1932) distinguish the weed *crusgalli* from the cultivated millet by its greater hairiness of the glumes, and the longish seeds. The millet is less hairy and has broader seeds.

Fischer in Gamble (1934) removes the group from *Panicum* and gives the plants a separate generic stand, viz., *Echionochloa*. Under this genus he ennumerates 3 species:—

1. *Echinochloa colona*, Link. = *P. colonum*, L.
2. *Echinochloa crusgalli*, Beauv. = *P. crusgalli*, L.
3. *Echinochloa stagnina*, Beauv. = *P. crusgalli*, L.

The cultivated species is treated as a variety of *colonum* viz. *E. colona* var. *frumentacea*, C. E. C. Fischer=P. *crusgalli*, Linn.var. *frumentaceum*, Hook.

The following is the description of the species as given by Gamble:—

Echinochloa, Beauv. Annual or perennial, often tall herbs. Leaves narrow. Inflorescence of crowded panicles of loosely arranged, secund, spiciform branches bearing spikelets from the base or near it; rachis triquetrous. Spikelets ovate

Composition of feeding stuff at different stages of growth.

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to elliptic or lanceolate—oblong, 2-nate or clustered, articulated on and falling entire from the pedicels.

Glumes membranous, unequal; the lower much the shorter, mucronate, cuspidate or awned, the upper coincident in outline with the spikelet, acute, cuspidate or shortly awned. Lemmas: Dissimilar; the lower equalling the upper glume (excluding cusp or awn) its palea 2-keeled, empty or containing a male flôret; the upper subcoriaceous or crustaceous, ovate, to elliptic-oblong, obtuse or apiculate, polished, very convex on the back, its pales as long, with rounded sides and flaps, containing a bi-sexual floret. Lodicules 2. Stamens 3. Styles free. Grain broadly elliptic, plano-convex.

Racemes simple, rather distant ·3 - 1·25 in. long; lower glumes and upper glumes about equal, obtuse or cuspidate. Annual, up to 2 ft. high; leaves 2-8 in long, ·1 - ·45 in. wide, ligule 0; spikelets ovoid ·1 - ·12 in. long; lower glume ·04 - 05 in. long; upper ·09 - ·11 in. long; lemmas ·08 - ·1 in. long lower with male floret........................... *colona.*

Racemes usually more or less branched ·8 - 2 in. long; lower glume and upper lemma cuspidate or awned, the latter the longer; lower lemma often awned:

Annual, up to 3 ft. high leaves 3 - 21 in. long; ·2 - ·5 in. wide, ligule 0, junction of blade and sheath glabrous, usually marked by a brown zone; spikelets ·15 - ·18 in. long; lower glume ·07 - ·12 in. long, upper ·15 - ·17 in. long; lower lemma empty, ·14—·17 in. long, upper ·12 - ·15 in. long; awn of lower lemma up to 2 in. long.......... *crusgalli.*

Usually perennial, up to 6 ft. high; culms rooting and often branching from submerged nodes; leaves 3 - 18 in. long, ·2 - ·4 in. wide, ligule a fringe of stiff hairs, sometimes absent on the uppermost leaf; lower lemma empty or with a male floret. Otherwise as in the last species .... *stagnina.*

Echinochloa colona (link.) var. *frumentacea*, C. E. C. Fischer: a taller and more robust plant with dense, sometimes corymbose panicle, cultivated.

Observations on flower pollination. Hildebrand (in Knuth 1909) reports that only self-pollination is possible in this species, owing to the simultaneous protrusion of stigma and anthers, but crossing may be effected when the anthers have fallen, as the stigmas are persistant.

Youngman and Roy (1923) found the flowers opening between 7-30 and 8-30 a. m. They observed that the stigmas and anthers emerge simultaneously. The stigmas spread out immediately on emerging, while the anthers dehisce only after about 1—1½ minutes. The glumes are observed to close back after half an hour.

Observations made at the Millets Breeding Station, Coimbatore on two types of panicle shapes, viz., open and compact, gave the following results The plants were grown under irrigated conditions. The observations were done on three plants in each type. The plants commenced to flower in about two months after sowing. The tip of the leaf subtending the panicle (flag leaf) appears first and takes about 10 to 14 days for the complete emergence of the flag. The appearance of the panicle is almost simultaneous with that of the flag, but its emergence is gradual, taking from 9 to 13 days.

The flowers begin to open in the same order as they emerge out of the sheath. The first flowers open as soon as the panicle tip emerges out. The order of flowering is thus from the tip of the panicle to the base. But in the

individual spikes the spikelets along the two margins open earlier than those at the middle. The flowering period is 19—22 days in the open panicles and 2 or 3 days more in the *compact* ones. The largest number of flowers open during the sixth to eighth day from the commencement of flowering. The opening of the individual flowers is between 5-10 a. m. The maximum number of flowers open between 6 and 7 a. m.

The glumes open out very gradually and at the mouth of the gaping glumes the two stigmas and the anthers stand out like a column. Two to four minutes later the stigmas emerge out of the lemma in a column and spread out on either side. The stamens thus come to occupy the central position. The filaments begin to elongate gradually in about 1 to 8 minutes after the spreading of the stigmas. The dehiscence occurs only when the filaments have elongated to their maximum. The dehiscence is by lateral sutures. It begins at both ends and meets in the centre. The glumes close again in about 5 to 10 minutes after the dehiscence. The stamens and stigma remain outside the closed glumes. The whole process, from the opening of the glumes to their complete closing, takes about 24 minutes.

Inheritance of characters.

I. *Anthocyanin pigmentation.* The only anthocyanin pigmentation met in this plant is purple. When the plants do not show any trace of the pigmentation they are designated as 'green through-out' (abb. GT.) The purple pigment normally manifests itself in the following regions of the plant:

(a) Vegetative parts—nodes, internodes, as two bands on the upper and lower sides of the nodes, leaf margins, midrib, sheath, panicle-rachis, glumes.

(b) Reproductive parts :— lemmas, anthers and stigma

Three grades of pigmentation designated P3, P2, P1, in descending order of their intensities, are met with. The anthers and stigmas show various colorations on drying corresponding to the grade of the plant-pigmentation. The following gives the chief differences between the various types:

Class of pigmentation.	Character and incidence of pigmentation: Vegetative Parts.	Reproductive parts: Anthers fresh	Anthers dry	Stigma fresh	Stigma dry
P.3	Deepest purple of all types	deep purple	deep blue	deep purple	black
P.2	Pigmentation less than in P_3	purple	a blue ring around the sutures	purple less than in P_3	dark brown
P.1	Pigmentation less than in P_2	yellowish brown	brown	light purple	brown
GT	No purple pigmentation, all green	yellow	brown	colourless	pale brown

A certain amount of fluctuation in the depth of pigmentation occurs in each of the three types. In the following segregations it was found that P.3 and P.2 groups were often rather difficult of separation and in certain cases the P.1 almost approached P.2.

(a) *Purple and green segregations:—*

Two kinds of segregations were met with, viz., a monofactorial and a bifactorial one.

The bifactorial segregations gave the following F_2 proportions.

Female parent = Green throughout
F_1 = P.2
F_2:—

	P.3	P.2	P.1	GT
Observed	266	80	88	44
Expected on 9:3:3:1	268·9	89·6	89·6	29·9

$X^2 = 7{\cdot}73$ $P > {\cdot}05$

In the monofactorial segregations the following F_2 proportions were obtained :—

Female parent = green throughout
F_1 = P. 1
F_2:—

	P. 2	P. 1	GT
Observed	29	71	33
Expected on 1:2:1	33·25	66·5	33·25

$X^2 = 0{\cdot}84$ $P > 0{\cdot}50$

The same proportions were met with in the further progeny of the hybrid. (Total of 9 families gave P. 2 = 330; P. 1 = 628; GT = 329. calculated P.2 = 321·75; P.1 = 643·5; GT = 321·75). This clearly indicates a 1:2:1 ratio. According to expectations all the P.1 selections proved to be heterozygous.

(b) In segregations between the three pigmentation groups, the 1:2:1 proportions were again met with :—

	P. 1	P. 2	P. 3
Total of 20 lots	751	1540	890

The P. 2 group is smaller and the P. 3 group larger than they should be for an exact 1:2:1 ratio, because their separation is not quite easy, the obvious P. 2 alone going into the middle group. Subsequent selections however showed that the P. 2 were all heterozygous and the P. 3 and P. 1 selections bred true.

It is evident from these that there are only two factors responsible for pigmentation in this plant. Further, it is evident that pigmentation differences between the heterozygotes and the pure ones are easier to be noted in the monofactorial segregations than in the two factor ones.

The factors may be designated as follows:—

$P_2P_2P_1P_1$	P. 3	$p_2p_2P_1P_1$	P. 1
$P_2P_2p_1p_1$	P. 2	$p_2p_2p_1p_1$	G. T

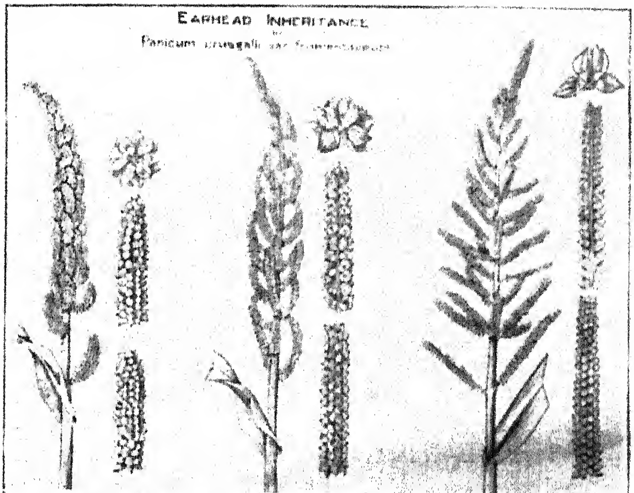

Fig. 1. (Top) Inheritance in ear-head shape. (Left) Compact head; (Right) Open head; (Middle) F_1; Single branches:—Top—cross section; Middle—rear and bottom—front view.

Fig. 2. (Bottom) Striped plant.

II. *The Panicle* (Plate I, Fig. 1). The panicle is conical in appearance. The number of panicles on a plant depends on its branching and tillering capacity. Each panicle is peduncled.

The peduncle is cylindrical and is continuous with the rachis, which however is angular. The spikes arise in whorls of 2 or more often 3—4, or sometimes 5. Each whorl thus constitutes more or less a node. The disposition of the whorls is more distant at the base and becomes less distinct and more congested towards the apex. The spikes arise on the face and not on the angle itself. They alternate in successive whorls so as to give a $\frac{1}{2}$ taxis. Thus the panicle shows a tetraquetrous arrangement. Consequent on the congestion towards the apex the whorls may become disturbed but still the tetraquetrous nature is kept up. The length of the spikes reduces gradually from the base towards the apex and the ultimate apex ends in a spike. This arrangement is responsible for the conical shape of the panicle.

The spikes are more or less ascending. The base of the rachis is somewhat pulvinate. The node at the base of the pulvinus is pubescent. Hairs, isolated or in tufts of 2—3 are found on the rachis, at the base of the spikelets. Groups of spikelets are arranged distichously along the dorsal side of the rachis. These groups consist of 3—4 spikelets distichously arranged on a short rachilla. The spikelets are all more or less equal in size. In general design they appear to be arranged in horizontal rows of 4 to 5 spikelets. The rachis attenuates towards the apex. The number of spikelet groups, however, remains the same and consequently the spikes tend to curve on their ventral side. This becomes more pronounced as the grains begin to mature. The spike ends may be seen almost spirally twisted and bent towards one side to avoid overlapping the upper one, so that the panicle gets a plaited appearance.

Two distinct types in head-shape could be distinguished, viz., Open and Compact.

In an open panicle the spikes are more or less horizontal and may or may not be curved towards the tip. The interval between the whorls is greater than in a compact panicle. The length of the spike is also greater and the spikelet groups are more spread out.

The compact panicle on the other hand shows the spikes much plaited. The spikes are much shorter and spikelets are very close together.

Further, the spikes in the 'opens' have a greater number of spikelet groups with usually 2—3, often 4, and rarely 5 spikelets per group. The 'compacts' on the other hand have usually only 3-4 spikelets per group, often 2 and very rarely 5.

An intermediate condition between the lax-ness of the 'opens' and the plaited appearance of the 'compacts' is met with. This is termed the 'semi-compact' head. In this the spikes do not completely overlap one another so that the main rachis becomes visible.

An analysis of typical heads gave the following results :—

Panicle type	Average number of spikelets	Average length of spike	Average number of spikelets per cm.
Open	26	2.8	9
Compact	22	1.9	12

Thus it becomes apparent that the headshapes are distinguished by the difference in the length of the spike and secondly the denseness of packing of the spikelets, i. e. the number of spikelets per cm. A similar experience is met with in the *E. coracana* also. (Ayyangar *et. al.* 1932).

III. *Sterility*. A case of male sterility was noted in a purple-pigmented plant. The emerging anthers instead of being purple were seen to be yellow and shrivelled up later without dehiscing. The anther sacs were devoid of free, healthy, pollen. This character was found to behave as a monogenic recessive to the normal condition.

IV. *Striped plant* (Plate I, Fig. 2). A single case of albino-striping was met with. This plant produced 31 tillers. The first was half albino and half green. The next six were all green and 4 white. Then again were formed seven green and the rest 10 white. Three tillers developing from the first were found to be green, though the parental one was half green and half albino. This is probably due to a chimaera, the mutation having taken place very early, probably even in the seed itself and affecting one half of the embryonal growing point, so that about half of the tillers is striped or white and the other half is green.

Seeds were collected from 27 tillers individually and progenies raised. The seed-setting in the heads from the green tillers was better (average 293 grains per head) than in those from the white ones (average 159 grains per head). The viability of the seeds was good (88% germination in seeds from green and 84% from those of white tillers). The progeny in either case (i. e., from the heads from green portion and that from white portion) gave green and pale seedlings. The proportions of green to pale seedlings were widely different :—

		Green	Pale	Ratio
i. Progeny from green tillers				
Total of 7 tillers	...	1074	350	3:1
„ 3 „	...	511	57	15:1 (approx)
„ 1 „	...	144	102	9:7
„ 3 „	...	254	327	7:9
ii. Progeny from white tillers				
Total of 4 tillers	...	414	168	3:1
„ 5 „	...	658	46	15:1
„ 1 „	...	58	50	9:7
„ 2 „	...	95	119	7:9
iii. Progeny from the half green and half white tiller	...	103	206	1:3 (approx)

On the total the progenies of this plant gave 3311 green seedlings and 1425 pale seedlings. Some of the pale seedlings that were allowed to

grow further put forth only green leaves. Neither the green nor the pale seedlings produced tillers with striping or albino.

Cytology:—Hector (1936) gives the following resume. "The chromosome number was first reported as ca. 48 (2n). According to Church (1929) the haploid number is 21. Avdulov (1931) found 54 (2n). Hunter (1934) 36. As the basic number of the Paniceae is 9, Avdulov's and Hunter's figures would appear to indicate polyploidy."

Echinochloa colona, Link. is a close relation of this plant which is cultivated as a millet in several parts of India and occurs wild all over the country.

E. colona appears to hybridize spontaneously with *E. colona*, var. *frumentacea*. The two plants can be distinguished easily by means of their panicle characters:

	E. colona	var. *frumentacea*
Rachis	Flat, triquetrous	Tetraquetrous
Arrangement of spikes	Bilateral, alternating	Whorled to spiral
Disposition of the spikes	Almost vertical and adpressed to rachis	Horizontal to ascending, divergent
Spikelets	Solitary or in twos, pedicelled	Always in groups of 3-5, sub-sessile.

The *colona* species itself sometimes shows a tendency to whorling. The weaker and later-formed panicles of *frumentacea* tend to be less whorled. The progenies of some natural hybrids gave in the F_2. a large number of intermediates with regard to the number of spikes and also the manner of arrangement

Summary. *Echinochloa colona* var. *frumentacea*, originally classified under Paniceae (*Panicum crusgalli* var. *frumentaceum*), though one of the less important millets of India forms a good famine time fodder and grain plant.

It can be fed green or as hay, or as silage. The plant has the advantage that it can grow in poor soils, as also under water-logged conditions.

Three pigmentation types P. 3, P. 2, P. 1 and one non-pigmented type GT. have been described. These show a two factor difference.

The panicle-shapes are of three types—Open, semi-compact, and compact. These are considered to be due to differences in the length of spikes and density of the spikelets. The relationships of these three types are yet not fully clear.

A type of male-sterility, simple recessive to the normal condition has been described. Albino-striping was met with and its progeny has given seedlings with green and pale colours in various proportions.

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The Cultivation of Betel vine (*Piper betel*) in Poonamallee village

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Introduction. In view of their proximity to Madras City, where there is a great demand for the leaves, betel vine cultivation is very important in the villages of Poonamallee and Kunnathoor. The area under this crop at present is about 350 acres. The crop is cultivated entirely under well irrigation, except for a few months in the year (October to March) when water from the Chembarambakkam tank is utilised. Unlike other crops which are raised by the efforts of individual farmers, a plot of betel vine garden is managed by a group comprising 15 to 20 men, who pool their resources to meet the cultivation expenses and likewise share the profit. The land is generally taken on lease, and the lease amount ranges from Rs. 75 to Rs. 100 per acre. About ten years ago, gardens when once started, used to flourish and yield well, even up to six years. Lately, the life of a garden has become shortened and now-a-days no garden thrives for more than three years. This is attributed to wilt disease, common in all the gardens in this tract. The gardens go by the name *Illangal thottam* in the first year, *Sambakkal thottam* in the second year, and *Muthukal thottam* in the third year. Each cultivator will have a share in each of the three stages of maturity, so that he may have a steady income

Varieties cultivated. The main variety cultivated is the *Ravesi* The leaves of this variety are of medium size, light green and not too pungent. The other varieties which are very sparingly cultivated in these parts are

Karpura and *Kammar*. The former resembles the *Ravesi* in shape, size and colour, but it is more pungent. The *Kammar* leaves are deeper green and broader than the other two varieties.

Planting season. There are two distinct seasons for starting a garden—January to February and June to July. Inspite of the advantages present in planting in June to July season, when owing to the receipt of North-east monsoon rains fewer irrigations will be required to rear the cuttings, the cultivators usually prefer the other season, because from experience, they have realised that the gardens started in January to February season yield better. This may be probably due to the dry weather that prevails during these months which facilitates quick establishment of the cuttings.

Calendar of operations.

Operations.	*Planting season.* *Jany. to Feby.*	*Planting season.* *June to July.*
Preparation of land (ploughing and trenching)	Jany.—Feby.	June—July.
Sowing *agathi* (*Sesbania grandiflora*) seeds in trenches.	Do.	Do.
Planting betel vine cuttings in trenches ...	April—May.	Septr.—October.
Initial trailing of the vines on the *agathi* 'standards'.	End of July.	End of December.
Tying bamboo or dried *agathi* poles horizontally, to the *agathi* 'standards' at a height of 6 to 7 ft. and forming arches.	September.	February.
First picking of leaves.	November.	April.

Details of cultivation. (i) *Preparatory cultivation.* Trenches, two feet broad and one and a half to two feet deep are dug along the length of the field, about four feet apart. Generally, no ploughing is done before the trenches are dug. Irrespective of the shape of the land, the total length of the trenches will be about 7,000 running feet per acre. Trench digging is usually done, on contract.

(ii) *Manuring.* The manures generally applied are cattle manure and horse dung. Sometimes, tannery refuse also is applied. Generally, no manuring is done at the time of preparing the land, but three months after planting the cuttings, farm-yard manure is applied at the rate of 25 to 30 cartloads per acre. From this time onwards manuring is done at the above dose, once in three or four months.

(iii) *Sowing the 'standard'.* On the ridges formed "*Agathi*" (*Sesbania grandiflora*) seeds mixed with "*Thagarai*" (another species of *Sesbania*) in the proportion of 4 : 1 are sown in lines. Generally four lines are sown with four to six seeds dropped in each hole, spaced six inches apart. Along with this, about 200 plantain suckers are also planted on the ridges. The plantain crop is raised primarily for its yield of fibre necessary for tying up the vines to the standards and for tying bundles of harvested leaves, but incidentally the crop yields a revenue from the bunches and

leaves which find a ready market. The *agathi* crop has to be irrigated from time to time and in about three months the standards will be about four to five feet high.

(iv) *Planting cuttings.* The next operation is the preparation of the flat surface of the ridges, to plant the vine cuttings. The surface is levelled and the edges are slightly raised to hold water. Cuttings with at least three nodes are planted in a slanting position, so that two of the three nodes are well covered by soil.

(v) *After cultivation.* These newly planted cuttings have to be irrigated (usually by splashing water stored in the trenches) four or five times a day during the first fortnight. During the third and the fourth weeks, watering is done twice a day and afterwards once a day. The cuttings strike root after about 30 to 40 days, and fresh shoots appear from about the 60th day onwards. About four or five months after the planting of cuttings, long bamboo poles (*agathi* stems from old gardens can be got at a cheaper rate) are tied horizontally to the *agathi* standards about six feet from the ground level. Out of the four rows of *agathi* standing on the ridges, two from one ridge and two from the next are bent and tied together just above the middle of the trench in the form of an arch. The growing shoots are generally trailed on the standards once in ten days or a fortnight. In about six months from the date of planting, the vines would have grown up to a height of about seven feet and the first picking of leaves can be done. If the vines are allowed to grow tall, gathering of leaves will become difficult. So, once in the first year and twice in the succeeding years, the vines that have grown above seven feet are brought down, the lower four feet coiled and covered up with earth. The distal ends of the shoots are trailed again on the 'standard'.

(vi) *Harvesting.* The first picking of the leaves can be done at the end of the sixth month after planting. In the first and second years the leaves are gathered once in a fortnight, while in the third year, the interval between two successive pickings is reduced to ten days and the quality of leaves obtained is slightly inferior. Usually the cultivators themselves and the members of their family attend to picking of leaves. Occasionally, outside labour is engaged, and each labourer is paid at the rate of one to one and a half annas for a basket full of leaves (6,400) gathered. Apart from the betel leaves, the growers gather tender *agathi* shoots at intervals of about one month and sell them in the market. There is a great demand for it as 'greens' and for feeding milch cattle. From the plantain suckers, about 175 bunches are got by the end of the first year. After harvesting the bunches, the mother plants are cut off, leaving one side-sucker in each stool. Thus, every year, about 175 bunches of plantains are also obtained; besides these, plantain leaves are also cut and sold. In addition, vegetables like brinjals, chillies, etc., are also grown (as a catch crop) here and there in the gardens. They are mostly used for domestic consumption and rarely sold.

Cost of cultivation per acre.

Details.	1st year.	2nd year.	3rd year.
(a) *Expenditure.*	Rs. a. p.	Rs. a. p.	Rs. a. p.
1. Digging trenches, 2 ft. broad and 1½ ft. to 2 ft. deep, 4 ft. apart, @ 2¼ annas for 50 running feet of the trench.	20 0 0		
2. Marking lines on the ridges making holes 6" apart on the lines and sowing *agathi* seeds 12 men at 4 annas each.	3 0 0		
3. Cost of *agathi* and *thagarai* seeds (24 M. M. at Rs. 2—8—0 per M. M.*)	60 0 0		
4. Cost of 200 plantain suckers at 1 anna each.	12 8 0		
5. Cost of labour for planting the suckers 8 men at 4 annas each.	2 0 0		
6. Cost of watering *agathi* on alternate days from the time of sowing to the time of planting the betel vine cuttings (3 months) at Re. 1—4—0 per watering.	56 4 0		
7. Taking mud from the trenches, plastering the sides of the ridges and rectifying the ridges just at the time of planting the cuttings and subsequently once in a month (9 times in the first year and 12 times in the succeeding years) 30 men for each operation at 4 annas each. ...	67 8 0	90 0 0	90 0 0
8 Cost of betel vine cuttings 135 bundles of 220 cuttings each at 3 bundles for a *Varahan* (Rs. 3—8—0).	157 0 0		
9. Cost of labour for planting the cuttings 20 men at 4 annas each.	5 0 0		
10. Cost of irrigation during the first fortnight (splashing water 4 or 5 times daily) at Rs. 2 per day.	30 0 0		
11. Cost of irrigation during the second fortnight (splashing water twice a day) at Rs. 1—8—0 per day.	22 8 0		
12. Subsequent irrigations (splashing water from the trenches) once a day at Re. 1-4-0 per watering—about 240 irrigations in the first year and 300 irrigations in the succeeding years.	300 0 0	375 0 0	375 0 0
13. Cost of tying up the cuttings to the *agathi* stems once in a fortnight from the 6th month onwards (12 times in the first year and 24 times in the second and third year) 10 men at 4 annas each for each operation.	30 0 0	60 0 0	60 0 0
14. Cost of 3,500 bamboos for tying the *agathi* standards at Rs. 5 for 120 bamboos. ...	137 8 0		
15. Cost of ropes required for tying the above.	15 0 0		
16. Labour required for the above item, 40 men at 4 annas each.	10 0 0		
17. Cost of labour for picking leaves at 1¼ annas for basketful of leaves (6,400)—four pickings in the first year, 24 in the second and 36 in the third year. In the first and second years 100 baskets per picking and in the third year only 50 baskets per picking.	31 4 0	187 8 0	140 10 0

* M. M. = Madras Measure (roughly three pounds).

Details.	1st year.			2nd year.			3rd year.		
	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
18. Cost of labour for gathering *agathi* leaves twice in the first year, 10 times in the second year and 6 times in the third year.	3	0	0	15	0	0	9	0	0
19. Manuring, twice in first year 4 times in the second and third years at 25 cartloads each time at Re. 1—8—0 per cartload. ...	75	0	0	150	0	0	150	0	0
20. Cost of labour for bringing down the grown up vines making coils of the lower portions, putting soil over them and trailing the young shoots to the standards—twice in the second year and twice in the third year, 80 men at 4 annas each for each operation.				40	0	0	40	0	0
21. Lease amount (Land).	100	0	0	100	0	0	100	0	0
22 Cost of levelling the fields and bringing to the original condition.							14	14	0
Total. ...	1,138	0	0	1,017	8	0	979	8	0
Grand Total. ...				Rs. 3135/-					

(b) *Receipts.*

Details.	1st year.			2nd year.			3rd year.		
1. By sale of betel leaves at Rs. 2 per basket of 6,400 leaves—1st year, 4 pickings, 100 baskets for each picking. 2nd year, 24 pickings, 100 baskets each time, third year 36 pickings, 50 baskets each time. ...	800	0	0	4,800	0	0	3,600	0	0
2. By sale of *agathi* leaves at 2 annas a bundle—400 bundles in 2 cuttings in the first year, 2,000 bundles in 10 cuttings in the second year, and 900 bundles in 6 cuttings in the third year.	50	0	0	250	0	0	112	8	0
3 By sale of plantain bunches (175) at 6 annas each.	65	10	0	65	10	0	65	10	0
4. By sale of plantain leaves, vegetables grown in the garden, etc.	10	0	0	50	0	0	30	0	0
Total. ...	925	10	0	5,165	10	0	3,308	2	0

Grand Total.	Rs. 9,899	6	0
Gross income for three years ..	9,899	6	0
Gross expense for three years ,,	3,135	0	0
Net profit for three years ..	6,764	6	0
Net profit per annum ..	2,254	12	8 or Rs. 2255/-

This amount has to be shared by about 15 cultivators, so, the net gain per cultivator per annum, will be about Rs. 150.

(vii). *Marketing.* The chief market for the leaves, is the city of Madras. Every day about 3 p. m. all the betel vine growers of the village assemble in a common place with the gathered leaves, cleanly washed, counted and arranged in baskets. The unit of sale is one *Kavuli* or hundred leaves. Merchants from the city come to the spot, the price for the day is fixed, and sales are effected.

Some years back there was considerable demand for these leaves from Northern India, but now-a-days those far off markets, have been reported to be captured by the betel vine growers of Sankaridrug (Salem District) and other places.

Pests and Diseases. The betel vines of these parts do not suffer from any insect pest, but the wilt disease is causing considerable damage. About 20 years ago each garden is reported to have fared well up to six years. Gradually, due to wilt disease, the life has been reduced and the gardener must now consider himself lucky if it survives for full three years. Recently, cases have been noticed where the vines have begun to wither even in the second year. The main cause of wilt disease is reported to be due to (i) cultivation of vine in the same land without adopting any rotation, or (ii) keeping the trenches always moist, a condition much favourable to the growth of the fungus. The ryots abandon the gardens when the disease has advanced to a fair extent.

The *agathi* 'standards' have been found to suffer from two insect pests, (a) Agathi stem borer, (*Azygophleps scalarids*) and (b) Agathi weevil (*Alcides bubo*). Generally these appear only as minor pests, but some times the attack may be severe. When the *agathi* plants are very young, if these pests appear on a large scale, the plants never grow above two feet, and in such cases also, the ryots abandon the garden and start afresh.

Phaseolus sublobatus Roxb. A new green manure and forage plant.

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1796

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A specimen of a leguminous plant (*Phaseolus sublobatus* Roxb.) known in Tamil as *Karum payar* was received from Sri. C. S. Seshagiri Ayyar, Agricultural Demonstrator, Perambalur, Trichinopoly District, for identification and on requisition he has given the following information regarding its cultivation in the Trichinopoly taluq.

An area of about 10,000 acres is grown under this plant in the Trichinopoly taluq as a mixture with irrigated *Cumbu* (*Pennisetum typhoides* Stapf and Hubbard) from April-May to July-August. After the harvest of the *cumbu* crop, the *Karum payar* crop is allowed to be grazed by cattle or used as green manure by puddling *in situ* for the next paddy crop. The plants which are grazed by cattle will soon shoot up and give sufficient quantity of green manure. The crop is also raised as a mixture in dry lands with cholam (*Sorghum* sp.) red gram (*Cajanus Cajan* (Linn) Millsp.), etc., and from this crop seeds are gathered for sowing in the next season. Seeds are not collected when it is grown in the wetlands. This green manure crop is preferred by the ryots first because it does not smother *cumbu* like

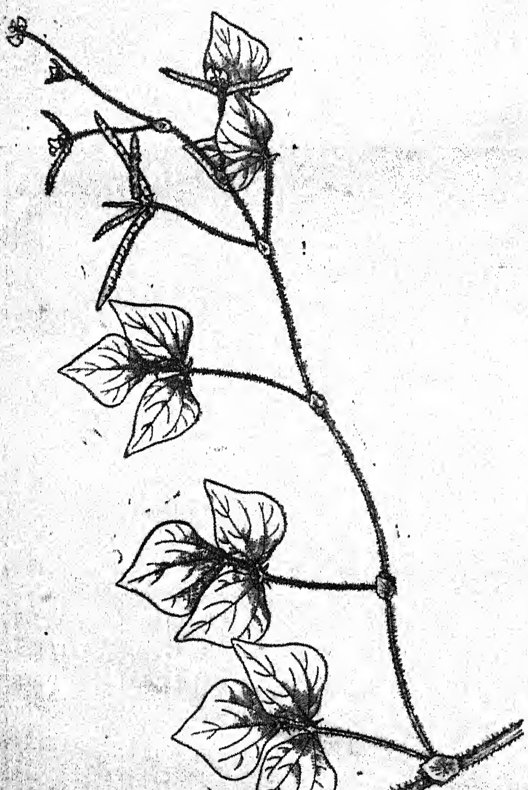
Daincha (*Sesbania bispinosa* (Jacq.) Fawcett and Rendle) and secondly it readily decomposes when puddled unlike *Daincha* which develops much wood if the paddy sowing season is delayed.

Phaseolus sublobatus Roxb. (Tam: *Karum payar*; *Mukani, Mataki,* Bombay; *Ghora Mung,* (Assam) is very closely allied to *Phaseolus aureus* Roxb. (green gram), of which it may be the wild form. It is also allied to *Pillipesara* (*Phaseolus trilobus* Ait.,) the famous green manure plant of the Telugu area. *Phaseolus sublobatus* Roxb. is more robust than *Pillipesara.*

It is found in the hills of Deccan and Western Ghats up to 6,000 feet altitude. It also occurs in the Konkhan, Bihar, Bengal and Ceylon.

The seed is rich in protein and is largely used as food in the Deccan during famine periods.

William Roxburgh in *Flora Indica* describes it as an annual while J. D. Hooker in *The Flora of British India* and T. Cooke in *The Flora of the Presidency of Bombay* describe this plant as a perennial herb. The following description of the plant will be helpful for its identification. Stems twining when meeting support, sometimes suberect, slender, clothed with spreading or deflexed reddish-brown hairs. Leaves three-foliolate; petioles 6—9·5 cm. long, channelled, very hairy; stipules 8 mm.-1·5 cm. long, ovate-oblong, hairy, slightly ciliate, attached a little below the middle. Leaflets, the terminal the larger and ovate or rhomboid-ovate, equal-sided, with cuneate base, 4·5—8·5 cm. long, usually as broad; the lateral ovate-acute, inequilateral, with rounded or truncate base, 3-8 cm. long, usually as broad, acute, silky-hairy on both sides, occasionally somewhat three-lobed, conspicuously three-nerved from the base; petioles, middle one, 1·8—2·2 cm. long, the lateral ones 3-5 mm. long, hairy; stipels linear-subulate. Flowers in short close 6-12 flowered recemes with swollen nodes; peduncles 1-3 cm. long, hairy; pedicels very short, 2 mm. long; bracts ovate, nearly 2 mm. long acute, ciliate, deciduous; bracteoles 3 mm. long, linear-subulate, ciliate, prominently nerved, deciduous. Calyx 3 mm. long, glabrous, shortly ciliate; teeth, shorter than the tube, deltoid.



Phaseolus sublobatus, Roxb.

Corolla 8 mm-1·2 cm. long, yellow. Pods 5·5 cm. long, slightly compressed straight, clothed with short reddish-brown hairs. Seeds 8-12, oblong with truncate ends, 2-3 mm. long, dark-brown and mottled.

This promises to be a very useful green manure plant suitable to be grown both in dry and wet lands. Cattle readily graze this even though it is beset with hairs. It therefore deserves to be tried under diverse conditions of soil and climate.

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Better Methods of Virginia Tobacco Cultivation in Guntur District.

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Introduction. Guntur district has nearly 50 per cent of the total area under tobacco in the Madras Presidency. During the past decade, as a result of persistent efforts of the India Leaf Tobacco Development Company, ryots have taken to the cultivation of Virginia tobacco and its curing in barns. The present area extends over 1,00,000 acres, fetching a return of about one and a half to two crores of rupees to the District. The country tobacco (*Natu*) extends over 50,000 acres and it may fetch another half a crore of rupees every year. Virginia tobacco produced in the Guntur, Kistna and Godavari districts forms the bulk of cigarette tobacco produced in and exported from India. With proper methods of cultivation, curing and marketing, it is possible in course of time to find a steady market in foreign countries especially the United kingdom for a fairly large quantity of high class leaf. Tobacco is at present the main 'money' crop in the Guntur district. Unless proper steps are taken to increase the yield and improve the quality of leaf and rectify some defects in other respects, the trade is likely to suffer in a very short time.

Importance of quality in Virginia Tobacco. Unlike other agricultural commodities, and other varieties of tobacco, the range of variation in the market price of Virginia tobacco, even on the same day, may be anywhere between Rs. 10 to 350 per candy of 500 lb. This indicates the extent to which quality is important in the crop. The aim of the Virginia tobacco grower should therefore be to produce as much of the high grade leaf as

possible to obtain better prices. There is always a good demand for high grade leaf for which remunerative prices are offered. Steps are being taken in several parts of India to introduce and extend Virginia tobacco cultivation. Naturally Guntur District is not likely to enjoy its present monopoly of trade in the commodity for long. It has also to be mentioned that of late virginia tobacco in the district has been showing considerable deterioration in quality and yield. On the other hand, it is behaving very well in some of the new areas along the Godavari and Kistna rivers. There is no doubt that Guntur District is one of the few places where good quality Virginia tobacco can be grown. Hence Guntur can still hold the monopoly if the ryots adopt judicious methods of cultivation and curing.

Factors affecting quality in virginia tobacco. The quality of cured leaf obtained is determined by a number of factors and they can be classified as follows :—

(a) Field factors affecting the development of proper colour of the leaf.

1. **Rainfall before and after-planting.**
2. **Nature of previous crop.**
3. **Manuring given to previous and present crop.**
4. **Time of planting.**
5. **Nature of seeds and seedling used.**
6. **Season during the growth of the crop.**
7. **Prevalence of pests and diseases.**

(b) Those affecting quality of cured leaf during the process of harvest and curing :—

1. **Method of harvest and handling.**
2. **Method of curing and handling.**

A good quality leaf from the barn is obtained from the crop that matures uniformly and produces the right type of yellowish green colour in the leaf. Factors such as rainfall are beyond control while the occurrence of pests and diseases are to some extent within human control. Proper methods of rotation and manuring, timely planting and use of pure seed can, however, be followed and they go a long way in producing the proper type of crop.

To produce good colour in the green leaf, virginia tobacco should not be grown on the same field more often than once in three years. It should not be preceded by a pulse crop or groundnut or by a heavily manured crop like chillies. Cereal crops have been found to be the best to precede it. If for any reason, cereals could not be sown in the preceding *pyru* season, the land should be manured liberally and a fodder crop (e.g. maize) raised from June to August. Tobacco can be planted in October–November following. In brief, the preceding crop should not be one that will enrich the soil in its nitrogen content, a factor that will adversely affect proper colour development in the green leaf. Raising tobacco too frequently on the same land will favour the spread of pests and diseases. Early planting (September end or early October) is good, whereever it is possible. Planting later than 15th December is undesirable as the resulting crop will not ordinarily develop sufficiently good colour in the green

leaf. Late planting is however, inevitable in some of the low-lying *Badava* lands. It is inadvisible to attempt planting in heavy deep clays, where good drainage faciliaties do not exist, before the cessation of the North East monsoon.

The most important factors adversely affecting the quality of leaf during harvest and curing are the following.

i Entrusting harvest and subsequent processes on a contract basis to a gang of coolies who pick over-ripe, ripe and un-ripe leaf together, and cause mechanical injury to the leaf while handling it.
ii. The absence of sufficient attention paid to curing methods by curers who do not understand the technique of curing.
iii. Curing over-ripe, ripe and under-ripe leaves together.
iv. Over loading the barn.

Contract work is usually cheap but the results are usually disappointing. If the grower exercises sufficient supervision in the field and at the barn, several defects of the system can be remedied. As bad curing results in loss of 25 to 50 percent of his profits, the grower would do well to learn the art and do the barn curing himself. If he cannot do it, he should at least procure the services of a good curer. It does not pay the cost of coal to cure the over-ripe, ripe and under-ripe leaves together.

Since two to four leaves are picked from each plant at a time, the stage of maturity will be different in each case. Experience has shown that it is desirable to sort out the green leaf after picking, into three grades with reference to their colour, and string them separately. The darker green leaf should be arranged on the top tiers the light green on the middle tiers and yellowish leaf on the lower tiers. The higher temperature near the flue pipes gives the over-ripe leaf at the bottom a chance to cure without sponging and the lower temperature and higher humidity at the top allows the dark green leaf to turn yellow quicker. The usual blemishes noticed in the cured leaf such as 'sponging', scalding, etc. are the result of over loading the barn with too many sticks, a habit which is almost universal in the district at present. By overloading, the leaves are kept so closely packed that some of them will not have the full benefit of the changes in temperature, aeration, and humidity to the right extent and at the right time, with the result, that they fail to cure well. The more thinly the barn is loaded the greater the possibility for the uniform distribution of temperature, aeration and humidity in it. What is gained in fuel consumption by loading the barn with too many sticks is many times lost in the quality of the cured leaf produced. It is known by experience that about 600 sticks in the small barn (16′ × 16′) and about 1,000 sticks in the big barn (20′ × 20′) form the optimum load.

How best to manure a Virginia tobacco crop:—To maintain yields at a high level and produce the right quality of leaf, it is necessary to manure the land in the right manner. Cattle manure in sufficient quantities is not available in the tract as nearly 15 to 20 acres are cultivated with a pair of

cattle. Heavy application of cattle manure induces rank growth resulting in dark-coloured coarse leaf which is totally unfit for barn curing. The use of artificials to supplement the natural resources of the soil, is therefore inevitable.

Nitrogen, besides assisting in the vigour and growth of the plant, has a marked effect on the quality of leaf. If a soil is poor particularly in its nitrogen content, light coloured leaf is produced. If heavy doses are applied, big coarse, dark green leaf with prominent veins is produced. Cattle manure, oil cakes, ammonium sulphate and nitrate of soda are the usual nitrogenous manures now available in the market. Black soils are generally rich in total potash. But as tobacco is a heavy potash feeder (about 100—150 lb. K_2O per acre per year) and as potash influences the quality of leaf, the available potash in the soil will not fully meet the needs of the crop. Potash manuring is, therefore quite essential for tobacco. A crop suffering from potash starvation will have in the leaves yellow mottling, dead specks, hobby-surface, and downward incurving tips and margins when green. Such leaves become harsh, dry, short and non-elastic when dry. Potash helps to improve the elasticity and fire-holding capacity of the leaf. The sugar content of the leaf is also improved by the supply of potash. Potash in the soil is rendered available by the application of sodium nitrate; hence the suggestion to apply half the quantity of nitrogen to the crop in the form of sodium nitrate. But there is the inevitable danger of leaching out of the nitrate during the heavy rains of September—October. Too much of potash turns the ash dark in colour. Phosphoric acid assists in an early, healthy development of the crop, regulates the rank growth resulting from too much nitrogenous manuring, hastens maturity and aids in the general colour development of the leaf. Lime is not required in Guntur soils which are rich in lime. If the burning quality (closer burn) is bad and snow-white ash does not result, about 30 lb. of magnesia (MgO.) with half of it at least in a soluble form, may be applied. Tobacco does not ordinarily require any other manure to improve its yield or quality. Under Guntur conditions manuring with about 10 to 15 lb. of nitrogen (N), 50 lb. of potash (K_2O) and 75 lb. of phosphoric acid (P_2O_5) in addition to 5 to 10 cart loads of cattle manure per acre appears to be the best dose. Some fields do grow good tobacco without manuring or with moderate quantities of cattle manure in certain seasons, but to ensure good crops of tobacco over a length of time, systematic manuring with artificials is inevitable.

Nitrogen is best applied as ammonium sulphate and sodium nitrate in equal proportions (25 to 40 lb. ammonium sulphate and 32 to 48 lb. sodium nitrate per acre), potash as sulphate (100 lb. potassium sulphate per acre), and phosphoric acid as superphosphate (450 lb. super-phosphate per acre.) Undue proportion of chlorides should not be included in the mixture. The above suggestions are based on the general conclusions drawn from the elaborate manurial trials carried out over a number of years and on various soil types by the Indian Leaf Tobacco Development Company. Cattle manure

is best ploughed in, in June—July and artificials drilled deep into the soil or spread over the soil and ploughed in whenever there is a dry spell of weather in August, i. e , about two months before planting. As tobacco is grown dry in the district, the full benefit of the manure applied cannot always be realised by the crop unless it is applied sufficiently early and well worked in.

Use of pure seed. The putity of the Virginia tobacco crop in the district is poor. With a mixture of indifferent types the cured leaf will be far from satisfactory. The use of pure seed (strain) of proved merit results in a pure crop that matures uniformly. This will naturally result in the production of a uniform quality of cured leaf. In no other crop does purity of seed play such an important part. Harrison special No. 9 has been found to meet the needs of the district very well. It grows well, has an ideal type of leaf and develps good colour wherever conditions are favourable. Growers have reported favourably on it. As compared to the local bulk crop, it fetches them an additional net profit of at least Rs. 25 per candy of produce As natural crossing is very common in this crop, it is not always the most vigorous plant in the field that is to be selected for seed purposes. Till a uniformly good quality crop is raised by the ryots themselves, they are advised to purchase their seed requirements from the Agricultural Department which is multiplying the pure strain and doing its best to supply as much seed as is wanted by growers. The price of pure seed required for an acre of planted crop is about 2 annas.

Raising nurseries. Under the present system of cultivation in the District, though a few big ryots raise their own nurseries nearly 75 per cent of the ryot population entirely depend upon the nurseries raised by professional nurserymen. This system has come into vogue for the following two reasons :—

i. Nurseries have of late been failing in black soils due to 'damping off'.

ii. It is easier to raise nurseries with success in the sandy soils and light loams, and seedlings from these areas establish much better on planting than those from the black soils.

In Guntur virginia tobacco cultivation has, assumed such industrial proportions that the man that raises the nursery is very often different from the man that grows the crop, the grower different from the barn owner and the barn owner different from the grader and ultimate exporter. As purity in the seedling stage cannot be easily determined, nursery men take little care to use good seed and the man that grows the crop pays the penalty. It is therefore highly desirable that this system vanishes soon. The next question is how best to raise tobacco nurseries in black soils. Before the I. L. T. D. company thought of raising nurseries in the Chirala sands, ryots were raising their nurseries in the black soils with success. Similarly, on the Agricultural Research Station, Guntur representing a typical black soil area, good nurseries are being raised with success from year to year. It

should therefore be possible to raise nurseries in the black soil areas. To achieve success, the present methods of raising the nurseries have to be modified and any amount of attention bestowed on them will not be too much.

The following are some of the precautions to be taken while raising a tobacco nursery in heavy black soils :—

i. Select a fertile high level sloping bit of land with a good water source such as a tank, pond or well near at hand. The water table should be so low that there is absolutely no danger of inundation or bad drainage even in the heavy rainy season.

ii. Make the soil permanently lighter in physical texture by heavy application of sand, tank silt, organic matter and green manures, to facilitate free movement of soil moisture.

iii. If chillies are also raised, tobacco and chilli nurseries should be rotated. Otherwise two plots may be set apart for tobacco and alternately put under tobacco nurseries.

iv. Plough the land deep after the North-east monsoon and apply liberal quantities of cattle manure, in December or January, and work it in well with the plough.

v. Keep the land ploughed till the end of July, then lay it out into a number of long beds, 4 to 5 feet wide with intervening drainage channels $2\frac{1}{2}$ feet wide and about 1 foot deep ranged along the slope, to facilitate quick drainage. The length of the bed may be adjusted with reference to the length of the field and general slope of the land. Periodical deepening of the drains and earthing up of the beds are necessary.

vi. About 3 or 4 days before the proposed date of sowing the seed beds, a fairly thick layer of cotton or red gram stalks, rejected cattle fodder, organic rubbish from the manure heap, casuarina twig, groundnut husk or any other type of inflamable materials may be spread evenly over the prepared nursery beds, and set fire to. This is best done when the air is still. The beds should not be burnt when they are too wet. As soon as the bed cools down, the ashes may be worked in lightly with hand hoes to prevent the ashes being blown off by wind. The beds are then ready for sowing.

Sowing of nursery beds. The beds should be raked and moderately compacted. The seed should be mixed with plenty of ashes or fine sand and sown evenly, distributing it twice across at the rate of about an ounce for a bed measuring 5′ × 150′. An ounce of tobacco seed contains about 3 lakhs of seed. The seed should then be pressed down with the palm of the hand or a flat board after sprinkling a small quantity of burnt soil on the sown beds. The practise of applying powdered cattle or sheep manure to cover the seed or just before sowing seed should be avoided as the manure may infect the soil with the fungus responsible for "damping off,"

Watering should be done with a fine rose-can till the plants are about three weeks old. Covering seed beds temporarily with casuarina leaf in the stages as adopted by ryots at Bapatla and Chirala is a practice worth copying.

After-care of nursery beds. Burning is done to kill the soil organisms that cause 'damping off' 'blackleg' etc. With favorable weather conditions, they attack the seedlings causing rotting and death. To avoid these diseases the beds should be thinned out wherever they are too thick. The thinnings may be planted where the beds are patchy. Such transplanting can be done when the leaves are the size of an eight-anna piece. If the seedlings are very weak or fail to do reasonable progress, sulphate of ammonia may be applied at about 5 to 20 ounces for a bed of 250 feet length. Similarly when the rate of growth of the seedlings has to be accelerated after a batch of seedlings are removed from the bed, the bed may be manured at 12 to 25 ounces ammonium sulphate for a bed of 250 feet length. The manure should be well mixed with sand or dry earth and evenly broadcast over the beds in the evenings. A heavy watering should be immediately given. As the plants usually become soft after manuring, at least a week should elapse before the seedlings so manured are ready for planting out. Even when manure is not applied, the seedlings should similarly harden off for about a week before being pulled out for planting. If proper attention is paid to weeding, control of insect and fungus attacks, an acre of nursery is expected to supply seedlings sufficient to plant at least 100 acres with sufficient seedlings left over for subsequent filling up of gaps. In black soils, many more seedlings can be expected from a unit area of nursery. At present ryots use at least five times the above seed rate to start with and sow more seed in the same beds whenever the nursery looks thin according to their own standard of judgment. In the majority of cases it is this thick sowing that encourages 'damping off'. In addition to the precautions mentioned above a weekly spraying with a suitable spray mixture containing a fungicide and insecticide is found useful to protect the tiny seedlings from diseases and pests. The first spraying should be done when the leaves of seedlings have attained the size of one's finger nail. The following mixture is recommended for the first two sprayings:—

Bouisol (Colloidal copper)	1 oz.
Lead arsenate	$\frac{1}{4}$ oz.
Agral (spreader)	$\frac{1}{8}$ oz.
Water	1 gallon.

If the above preparations are difficult to obtain, the following spray mixture is recommended.

Copper sulphate	1 lb.
Quick lime	1 lb.
Lead arsenate	4 oz.
Water	$12\frac{1}{2}$ gallons.

The copper sulphate is dissolved in half the quantity of water. The quick lime is first slaked and then diluted in the remaining quantity of water. Copper sulphate solution is added to the lime solution slowly and the

mixture thoroughly stirred during the process. Lead arsenate is added to the mixture and thoroughly stirred.

Periodical sowings. For convenience of planting and to reduce risks to the minimum, big cultivators are advised to sow their nurseries at intervals of a week or so, preferably in different places, so that, if for any exceptionally unfavourable weather conditions at a particular time one sowing cannot be saved, at least the others may be saved.

Watering. The amount and frequency of watering to be given to the seed beds in the black soil areas are different from those in the sandy soils, and ryots should use their judgement in this respect. They are more often damaging their nurseries by over-watering in these soils. Water thoroughly at *longer* intervals rather than frequently.

The following additional hints are helpful for raising a good crop.

1. Do not use any tobacco refuse or sweepings from barn yards for the nurseries. Diseases like mosaic powdery mildew etc. and seed contamination may take place through this source.

2. Reject beds that show mixtures and rogue out off-types if they are few and can be detected in the nurseries

3. Use seedlings of the same age for planting a field as otherwise all plants do not come to maturity at the same time.

4. Reserve enough seedlings in the seed beds for gap-filling as the resulting crop will be uneven and impure if seedlings for this purpose are obtained from another source.

5. Try to fill up gaps as early as possible to get a uniform crop at maturity.

Tobacco seed a useful bye-product. An acre of Virginia tobacco on an average gives 200 lb. of seed and most of it is at present wasted. Recent investigations have shown that tobacco seed yields 25 to 30 per cent oil in country wooden mills as against 40 per cent yield of gingelly seeds. The quality of oil compares favourably with high class gingelly oil in colour, taste and flavour when extracted in the country mill. Oil extracted by the hot drawn process tastes some what bitter. Sheep and goats freely eat the seed without any untoward consequences. Cattle also seem to relish the seed, but these are rarely fed with it for fear of bad consequences.

From the reports received so far, it is clear that the oil and cake are free from harmful substances. The cake compares well with castor cake as manure. The oil can be classed as a semi-drying oil with some special properties of its own. At a modest estimate, valuing the oil on a par with linseed oil and the cake with castor cake, an acre of tobacco may yield a net return of Rs. 12 deducting Re. 1 for harvest and threshing the fruit capsules and Rs. 5 for the extraction of oil.

Acknowledgements. I take great pleasure in acknowledging my indebtedness to Sri. R. Swami Rau, Assistant Director of Agriculture, Guntur for the facilities rendered during the course of my studies and for his valuable suggestions in writing up the paper.

A. Pests. **Appendix—Pests and Diseases of Virgina Tobacco in Guntur.**

Name.	Nature of injury.	Control measures.
1. Tobacco Caterpillar (*Prodenia litura* F.)	A severe pest of the planted crop. Caterpillars feed on the foliage both in the nurseries and transplanted areas.	Spraying of lead arsenate at a strength of one oz. in two gallons of water. Hand picking of caterpillars wherever possible.
2. Tobacco nursery caterpillar (*Laphygmaexigue* Hb.)	A severe pest of the nurseries at Chirala where large scale nurseries are raised. Caterpillars devastate the nursery beds by feeding on the newly formed leaves of the sprouting seedlings in the nursery beds.	Growing a trap crop of *ragi* all round the tobacco beds and pulling it out at 5 to 6 days interval for the destruction of the egg masses and cater pillars on them. Alternate sowing and pulling out has to be done at 6 days intervals.
3 Plant lice (*Myzus persicae* S.)	A pest of planted crops. Severe in the lankhas of E. Godavary. Colonies of insects infest the leaves, suck the sap and affect the vigour of the plant. Causes curling of leaves.	Spraying with tobacco decoction plus soap.
B. Diseases etc.		
1. Damping off, (*Pythium* Spp. *Rhizoctonia* Sp.)	Occurs in the nursery. Seedlings attacked at ground level. They fall over and rot. Seedlings are destroyed in patches.	Use of raised, well-drained seed beds. Burning of nursery beds by open fire method. Thin sowing. Regulated watering. Periodical spraying with a fungicide (see text).
2. Black leg. (*Bacillus aroideae*)	Occurs in the nursery. Blackening of the seedling and death. Seedlings are destroyed in patches.	do
3. Powdery mildew. (*Erysiphe cichoracearum*).	Occurs in the transplanted crop Rare in the nursery. Forms a white powdery layer over both surfaces of leaves; favoured by dry weather and cold nights and shady situations.	Dusting with flowers of sulphur in the nursery stage. Priming (removal of lower leaves) the grown up plants up to height of 12 to 15 in. from the ground level. Application of ground sulphur to the soil immediately around the stem.
4. Orobanche. (a flowering root parasite) 1796	Causes stunted growth due to the parasite sending its roots into the roots of tobacco.	Pulling out the parasite as soon as the shoots appear above the ground. Burn or bury deep the pulled out plants. Avoid feeding the pulled out parasite to farm animals and prevent them grazing on the parasite.
5. Mosaic. (Virus disease).	Mottling of leaves caused by alternate lightand dark green patches. Blistering in severe cases. Stunted growth and production of narrow leaves lacking in 'body'. Poor quality of cured product.	Sterilisation of seed bed soil or yearly change of site for nursery beds; thorough cleaning of the seed. Cleaning up of stems, trash &c. from the site of beds. Weeding out of ratoon tillers, stubbles and solanaceous weeds from the field. Examining nursery beds and roguing out mosaic infected seedlings. Roguing of plants at the first cultivation of the transplanted field.

SELECTED ARTICLE

The Man and the Plant.

By H. MARTIN LEAKE, M. A. Sc. D.

Cotton is an agricultural product, the product of a plant. Its successful cultivation, apart from the financial aspect, must conform, therefore, to two requirements. It must provide both the essential conditions which the nature of the plant as a living organism demands, and the amenities which man, the producer, considers to be his due in return for his labour. But there is no question as to which of the two is the more fundamental. The plant is a sentient, but unreasoning, organism and can only adapt itself to a certain limited range of conditions. The plants in a greenhouse will die if left unwatered for a few days, and the fact that the absence which led to the neglect was unavoidable makes no difference to the result. With man the vital limits are wider, but he is reasoning and not only can, but does, voice his protests in strikes and rioting long before those limits are reached. This is a simple proposition, but one which is frequently over-looked. The human requirements, for the above reasons, assume primary importance, and the protest of the plant, because silent, is ignored.

The cotton plant, with plants in general, will only grow and mature its crop if the conditions, and the environment, fall within somewhat narrow limits. If rainfall, air-humidity temperature and so on transgress those limits failure will result, though a time-factor is here involved, the extent of the injury being dependent on the duration of the exposure to the adverse factors. These are physical factors, but they are not the only ones concerned; there are the factors concerned with the soil, also physical factors, and there are biological factors which influence the resultant crop, weeds, pests and diseases. It is the function of the successful farmer so to alter the conditions existing in nature that the plant throughout its growth is never subjected to such adverse conditions. It is an objective rarely, if ever, attained, for man has only a partial control over the environment. Herein lies the fundamental difference between agriculture and industry; in the latter the conditions are under the full control of man.

There is here implied the dependence of success on a detailed knowledge of the particular plant in relation to the environment, and it is a knowledge which is of two kinds. There is the knowledge which concerns the effect of those rapidly changing factors of the environment, seasonal and daily changes of temperature and rainfall. These require immediate action, and decisions must be taken by the cultivator himself. It is knowledge which has been acquired by farmers of all races in greater or less degree as the result of the accumulated experience of generations. Then there is the knowledge of those more subtle influences, nature of the soil, availability of plant food, the life-histories of the various pests and diseases and so on the prerequisite to control. These are technical matters which require and technical investigation to acquire and technical control to apply.

It is possible, in view of the above, to define agriculture as the adjustment of the environment to the needs of the particular crop plant—perhaps the most comprehensive definition of agriculture there is. To achieve this objective three conditions must be fulfilled: skill on the part of the farmer, technical investigation, and technical control. But there is a further aspect. Where the conditions of growth cannot be sufficiently altered to suit the plant's requirements, it is often possible by careful search to find a variety which is capable of

growing under the conditions better than any variety hitherto available. It is a process which has been adopted instinctively through the ages and now forms a standard operation with all crops and in most countries. But recent advances in the technique of plant breeding have gone further and rendered it possible within reasonable limits to manufacture varieties having the desired adaptability. This alteration of the plant to suit the environment is a matter for technical investigation.

The human aspect demands requisites of a different nature. Primitive man is readily satisfied with little more than the absolute essentials to maintain life-food and a minimum of clothing and shelter—but this simple state is everywhere passing. With the spread of education, news and facilities generally, he is coming to recognize that there is a more desirable standard of life only to be obtained by the retention of a larger fraction of the return for his labour. It is inevitable that this urge on his part should bring him into conflict with those who handle his product and are naturally unwilling to reduce their share of the return. As long as demand exceeded supply, as was the case until early in the present century, this adjustment could be made within reason at the expense of the ultimate consumer. But latterly, contracted demand and vast increases in supply have made adjustment by such a method impossible. These forces have created conditions under which not merely has it become impossible to maintain the progressive advance in labour's material welfare, but actual reduction has taken place in some cases. If the labour force engaged in tropical agricultural production has progressed in its views as to what constitutes an adequate standard of life, it has not yet learned to appreciate the influences at work which restrict its capacity for earning. Herein lies the stimulus to the unrest which has characterized recent years not only in the tropical colonies but in general. Being capable of action labour has protested, and often with violence, and the strength of the movement of unrest has forced the human needs to the front, not infrequently to the neglect of the more fundamental needs of the silent plant. In practical life it is no answer to say, if the facts do not fit the theory, so much the worse for the facts. Facts have an unpleasant way of asserting themselves, and a solution to the present problem can only be sought through a recognition of its dual nature. The solution will not be found through argument on *a priori* grounds; the best approach will be made through a review of the various systems found in action and of the response in each to the changed conditions.

During the early history of colonial development a purely nationalistic view prevailed: development in the interests of the mother country, as witness the Navigation Laws and the slave trade. Under it arose a system of plantations worked by a labour force composed originally of slaves, and later of wage-earners often bound by indentures. With the passing of slavery a change of sentiment took place which slowly crystallized out at the end of last century in the dictum of Chamberlain: the trust for civilization. Under it, the insistent demand for the products of tropical agriculture was to be met by extended cultivation by the readiest means then available. The plantation system, and the results are to be traced in the encouragement of settlement in Kenya. It was assumed rather than argued that from such a development benefits must automatically accrue to the native populations. Another quarter of a century elapsed and a further change of sentiment took place which crystallizes out in Article 22 of the Covenant, the trust of the native populations. It was a sentiment which Lord Lugard, with a prescience in advance of his time, anticipated by a quarter of a century. The readiest means were discarded and the more leisurely method through a system of peasant proprietors was adopted, and this course was facilitated by the lessening urgency of the demand owing to the large extension in the sources of supply. It takes note of the human aspect and again, it was

Liebig's Mineral Theory of Plant Nutrition—Acharya C. N. *Indian Farming* 1: (1940).

It is now exactly a hundred years since Liebig propounded his mineral theory of plant nutrition, which stated that plants need be supplied with minerals only in order to provide for normal growth. It synchronized with the change-over from an era of natural or organic manures to a new era, which believes in the potency of artificial fertilizers, properly used. In the early stages of the enthusiasm for artificials, the case for natural organic manures which were in use through thousands of years was overlooked—with disastrous results in several cases by way of a rapid deterioration in the physical condition and fertility level of the soil. The manurial pendulum has now swung to a middle position between the age-long practice of using organic manures alone and the immediate post-Liebig belief in the sufficiency of artificials alone. Present-day practice aims at combining the advantages of both systems by returning to the soil as much of farmyard manure, composts and other natural manures as can be obtained and using artificials as supplements in order to obtain peak yields. The relative amounts of organic and inorganic manures that can be used with advantage for any crop will depend on a number of factors such as the nature of the soil, the nature of the crop and relative prices of the two classes of manure on the farm. Recent work, both on the agronomic and on the scientific sides, has shown the essential limitations of the purely mineral hypothesis put forward by Liebig for the nutrition of plants. Controlled experiments in solution cultures, containing only mineral salts, have shown that though plants can be grown for one or two generations in such media, they deteriorate rapidly if grown through a number of generations with seed obtained from the previous mineral solution cultures. This has been found to be due to the lack of essential phyto-hormones which are carried in small amounts in the normal seed grown in the soil and are found in abundance in organic manures and also in soil organic matter. In the temperate and colder climates, where the soil contains a good percentage of organic matter (5 to 10 per cent) and the rate of oxidation is slow, the return of the root systems of crops may be sufficient to maintain the soil in good physical condition; and continuously high yields may be obtained for decades together by the application of artificials alone, as evidenced by the results of the permanent wheat plots at Broadbalk (Rothamsted). But the case is different in the tropics, where the soil contains barely 1 to 2% of organic matter and the rate of oxidation of added organic matter is high. The return to the soil of the root-system alone is insufficient, under tropical conditions, to maintain the soil in proper condition. For this purpose additional quantities of bulky organic manures in the form of farmyard manure, composts or green manures, have to be added almost every year. Already, the system of using 'straight' artificials is yielding place to an alternation or conjoint use of organic and inorganic manures M. K.

Feeding of Milking Stock. Kartha K. P. *Indian Farming* 1: (1940).

Cattle improvement in India is as much a matter of feeding and management as breeding. While better breeding may produce an improvement of 10 to 12 per cent in milk yield from generation to generation, better feeding and management alone can be relied upon to produce an immediate increase of 50% in ordinary Indian cattle. Feeding of milch cows in villages is done haphazard without any regard to the requirements of the animals. In many cases, cattle are seriously underfed while in others there is considerable overfeeding, both of which affect milking efficiency. The object of giving food to milch animals is to provide the energy required for performing the various functions. In the feeding of animals, therefore, care should be taken to see that (1) you provide sufficient food for the animal to perform its vital functions viz. the 'maintenance ration', (2) you provide extra food for the production of milk viz. 'the production ration'

and (3) that the quality of the food is such that it contains enough proteins, minerals and vitamin viz, 'a balanced ration'. The quantity for maintenance will depend upon the live weight of an animal and that for production on the amount of milk produced. The actual quantity will also depend upon the quality of the feed. If good fodder is available, a mixture of green and dry fodder fed *ad lib* should provide the requirements for maintenance. If fodder is of poor quality, the maintenance ration should contain in addition 5 lbs. concentrates in the case of buffaloes and 3 lbs. in the case of cows. Production ration is supplied in the form of concentrates like gram, oil-cakes and bran and the optium requirement is one lb. of a suitable mixture of concentrates for every 3 lbs of milk yielded.

The following are a few typical mixtures found suitable for milch cattle.

Mixture.	Bran.	Crushed gram.	Crushed barley.	Crushed cotton seed.	Crushed groundnutcake.
1	4	1	1	-	2
2	4	-	2	-	2
3	4	1	1	2	-
4	5	1	-	-	2
5	4	2	-	2	-
6	4	1	2	-	1
7	3	-	2	3	-
8	3	1	2	2	-
9	5	-	1	-	2

M. K.

The control of Nut grass in the Sudan Gezira. F. W. Andrews. *Empire Journal of Experimental Agriculture.*

Nut grass *(Cyperus rotundus L.)* is reported to be a troublesome weed in the irrigated cotton land of Gezira--a flat plain lying between the Blue and the White Niles. It was found that the eradication of this weed was fairly accomplished if a root cutting implement (corresponding to blade harrow or *Guntaka*) was drawn through the soil at a depth below that of the lowest tuber and the disturbed soil containing the tubers left in a dry condition. A good many of the tubers were about six to nine inches below the ground surface. Repeated cultivation of the land may eventually destroy this weed. M, K. R.

Rice Straw and Molasses for Range Cattle R. C Macahalig. *Philip. Agriculturist*, (1939), 28, 561.

In view of the efforts to widen the basis of an industry hitherto largely dependent on monoculture and to find an outlet for excess molasses these experiments on the use of rice straw and molasses as supplements for grazing cattle will be of interest. During the dry season (112 days) the average increase in weight was 29·43 kg for cattle with supplementary feed against 1·43 kg for those fed on pasture alone. This was definitely economic. During the west season (196 days) the respective increases were 19·93 and 16 45 kg., a difference which was uneconomic. *International Sugar Journal*, 42 (1940) 256.

Manufacture of "Leesa" Soft Sugar in India. S, D. Agnihotri *Proceedings of the 6th Convention of the Sugar Technologists' Association of India*, pp. 485—486. There are several factories in Bombay producing a soft sugar, e. g., *Leesa* made by crushing refined beet or Java special crystals and mixing it with 9 to 15 per cent of 5A corn glucose (35° Be.) of the Corn Products Co. (India). *Leesa* so made forms hard lumps on keeping, and invert sugar gives a product which is better in feel and in keeping quality. Japanese Leesa appears to contain a fat, which the author was unable to identify. No modern sugar factory in India has undertaken to produce *Leesa*, though from the prices ruling for that imported from Japan the margin is quite alluring, (*International Sugar Journal*, 42: (1940) 253).

Gleanings.

Healthier Plants. From the Horticultural Department of the American Chemical Paint Company comes news of the commercial production of a vitamin hormone stimulant, *Transplantome*, for plants, that not only invigorates old roots but also multiplies the production of new ones, reduces the loss which frequently occurs with transplanting operations, and reduces wilting. It is applied to rooted plants to add to existing root growth and to force their general growth. *Transplantome* is a water-soluble powder impregnated with vitamin B_1 and other parts of vitamin B_1 fraction, plus root-promoting hormones. The hormone initiates root growth and plant physiologists assert that the Vitamin B chemicals are necessary for the maintenance of their growth. That it is quite concentrated is obvious for it requires only one level teaspoonful to a gallon of water to make a stock solution which is then further diluted. Seedlings may be lightly sprinkled weekly, or it may be applied to plants set out in the soil, whether they be trees, shrubs, vines, annuals, or perennials In the case of plants which are set out without a ball of earth, the manufacturer recommends that the roots be soaked in the stock solution for an hour. Treatment usually results in vigorous and extensive root growth and this, in turn, requires more frequent watering than is ordinarily necessary. The manufacturer further claims that, owing to frequent clipping, grass is unable to produce enough vitamin and hormone naturally for the roots and that watering with an ounce of stock solution to three quarts of water will improve turf quality. Sods similarly treated before being set in place will also readily form new roots. (*Science and Culture* 6: 219.)

Indication of a New Chick Growth Factor in Rice. Hogan and his co-workers (*Jour. Biol. Chem.*, 64, 113, 1925) suggested that polished rice contains a chick growth factor not present in any significant amount in yeast. MacFarlane *et al* (*Jour. Nutrition*. 4, 331, 1931) supported this observation. Stokstad and Manning (*Poultry Science*, 18, 413, 1939) studied this problem and found that polished rice has a growth-promoting effect which cannot be provided by levels of dried yeast up to 15 per cent of the ration. Very recently Almquist, Stokstad, Mecchi and Manning (*Jour. Biol. Chem.*, 134, 213, 1940) have found that glycine is required in the diet for optimum growth of the chick. When adequate glycine is present in the diet chondroitin has a growth-promoting action on the chick. A combined effect of glycine and chondroitin can replace the "rice factor".

(*Science and Culture*, 6: 239.)

Correspondence.

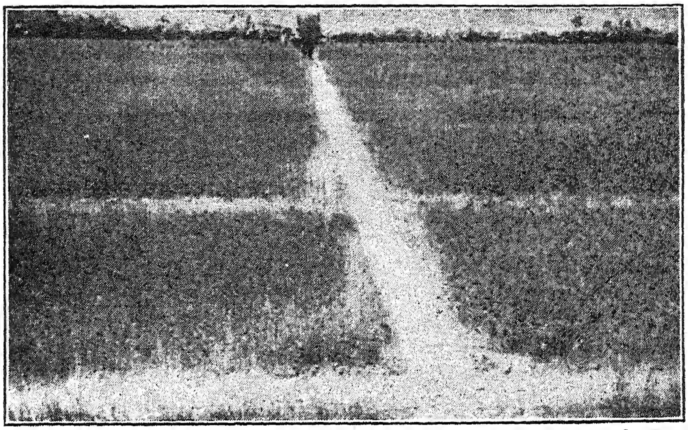
To The Editor, Madras Agricultural Journal.

One-cent paddy nurseries.

Sir,

I enclose two photographs of one cent paddy nurseries the value of which has been demonstrated to ryots and which was a feature of the landscape on the main bus route in the Mayavaram to Tiruvarur Road between June and September 1940. These are representative of the 4574 one cent nursery plots laid in 56·76 acres of nursery raised during the period.

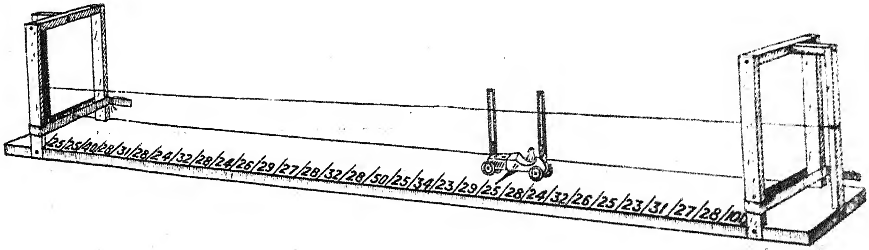
After the last ploughing the nursery fields were levelled by a levelling board drawn by a pair of bullocks, the fields marked out into plots of 8 feet breadth and 54 feet length with channels one and half feet wide all round The plots thus marked out were again levelled with a hand levelling board the coolies



ONE-CENT PADDY NURSERIES

Top. A view of adjacent plots showing the channels on all sides.

Bottom. Another view showing the uniformly grown seedlings ready for transplanting.



A novel device for pushing sale of Groundnuts.

working from the intervening channels. Water was then let in to about an inch depth and allowed to stagnate in the beds for a few hours. The sprouted seed was then measured out at 1 Madras measure per plot for *samba*, 1½ M. M.* for *Kuruvai* and 2 M. M. for *Udukuruvai* and handed over to the sowing coolies who went round the plot twice or thrice along the intervening channels scattering the seeds uniformly.

This method of sowing ensured uniform and good germination of seeds and uniform growth of seedlings as there was good drainage. The method also prevented the formation of foot print pockets caused by labourers walking over the beds which is unavoidable in the local method. The seedlings were transplanted in singles 4 inches apart in *Kuruvai* and 4 to 5 inches apart in *Samba*. The Kuruvai yields have given an average increased yield of about 10% over the bunch planting apart from a saving of 50 per cent. in seed.

Agricultural Demonstrator's Office,
Mayavaram.

Yours etc.,
M. J. David.

To The Editor, Madras Agricultural Journal.

A Novel device for pushing sale of Groundnuts.

Sir,

Groundnut has long been recognised as a very palatable and cheap "nut" though people seldom realised its high nutritive value. Roasted groundnuts are often sold exposed in shallow bamboo trays at street corners or in the vicinity of toddy shops, in most of the towns, by old women, but are patronised only by labourers or poorer class of people chiefly because they are sold under dirty conditions, or in uninviting surroundings. Other people go in for this tasty and cheap "munch" only at places of public resort, like parks, sea-beach, or theatres when it is sold by decent-looking mobile vendors. A new method of selling groundnuts now prevalent in the West Coast towns and which has come to my notice recently, is described below with the hope that it would be of interest to others particularly at this time when much is talked about the restriction of area under groundnuts and stimulation of internal consumption to meet the situation brought about by the closure of foreign markets and the consequent lack of export trade.

The new device is an adaptation of a contrivance for a game of chance to the sale of groundnuts, which easily provokes the crowd that gathers round it to try their luck. It consists of a wooden plank about 4½ feet long and 6 inches broad, one edge of which is divided into a number of small spaces each marked with a number in the following order, viz., 25, 25, 40, 28, 31, 28, 24, 32, 28, 24, 26, 29, 27, 28, 32, 28, 50, 25, 34, 23, 29, 25, 28, 24, 32, 26, 25, 23, 31, 27, 28, 100. (Vide illustration). Over this plank a small toy car is flicked, the movement being confined to a straight path by providing at each end of the car, a vertical metal piece having a longitudinal slit through which passes a galvanised wire. The wire is drawn tight and fixed to two vertical struts at the two extreme ends of the plank. Three inches from each end two more struts are fixed and a narrow strip of rubber is tightly tied round them to act as springs for throwing back the toy car when it is flicked backwards or forwards. The toy car is provided with a pointer towards the side of the plank on which the numbers have been marked. The set is made locally and costs only about a rupee.

On receipt of the token money which is only a pie in this case, the vendor—generally a boy—who sits on the road side with a bag of roasted groundnut pods gives a flick to the toy car. The car moves forward, strikes against the strip of rubber, recoils back and finally comes to rest, its pointer standing over some

* M. M. means Madras measure=3 lb.

number painted on the plank. This number of roasted groundnuts is then counted out to the man who has had his chance. The idea of trial of luck being contagious spreads through the whole crowd that gathers round this novel contrivance. The vendor by this simple method is able to drive a brisk sale up to about Rs. 1/8 to Rs. 3 a day and earn a profit of annas two for every rupee worth of groundnut sold. In a small panchayat like Pattambi in South Malabar about half a dozen such sales-boys are said to operate during the season. It has also been gathered that this method of selling groundnuts is prevalent in many other small towns in the West Coast and has spread even to the States of Cochin and Travancore. The method proves attractive and may be introduced elsewhere as well.

Agricultural Research Institute,
Lawley Road, P. O., Coimbatore,
Dated the 8th November 1940.

Yours &c.

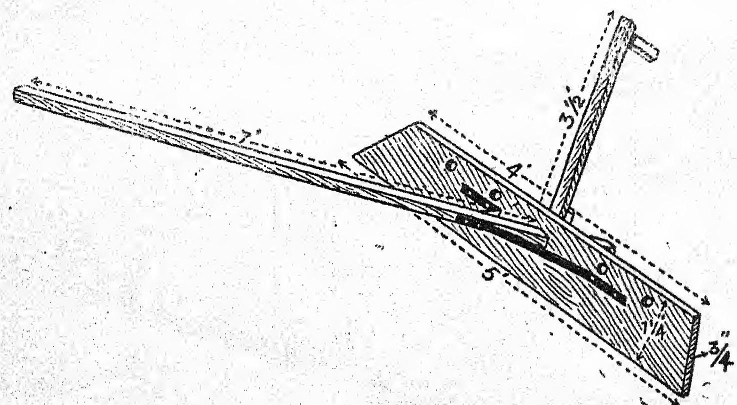
C. M. John.

To The Editor, Madras Agricultural Journal.

A newly designed bullock-drawn levelling-board.

Sir,

In wet lands levelling is usually done for paddy nurseries to get good, even germination of paddy seeds. It is not generally done for transplant fields. It is specially so in Tanjore Delta and in all other districts where irrigation water is supplied to wet lands from big projects. Wherever there is a plentiful supply of irrigation water, ryots do not bother about levelling wet lands. Even if land should be uneven from one end to the other, they can let in water in plenty to reach the other end. But the case is different with dry districts like Salem, North Arcot etc., where water is baled out from deep wells to raise paddy crops. Ryots in these districts have necessarily to keep their land perfectly level so that they can easily, quickly and economically irrigate their crops. The levelling of wet land further helps even growth of plants, even flowering and maturing of grains, which must result in greater yield. For securing such levelling in wet land, a new levelling board was designed to be worked by cattle.



The implement (see illustration) consists of an ordinary level plank 5 feet long at the bottom, 4 feet at the top, 1¼ feet deep, and ½ to ¾ inch thick, to which a shaft-pole 7 feet long is fitted about 3 inches from the top edge and at right angles to the plank at the centre. The two long edges of the plank are made straight and even. It is provided also with a wooden handle about 3½ feet in height. The shaft-pole passes through the plank and through the handle at the back and firmly secured behind by a wooden peg. Two iron brackets are

provided binding the shaft-pole to the plank in order to give steadiness and even pull to the levelling board. Four holes about 1½ inches in diameter are symmetrically made on both sides of the plank about 3 to 4 inches from the top edge. This is to provide an outlet for excess water that may be collecting over the puddle when the implement is working as there is no need to drag the water also. It will give some relief to the cattle by lessening the strain.

The implement is to be worked in wet lands as the last operation before planting paddy and when the field is in a well-puddled condition. Wherever there is uneven ground which can be easily spotted out by having 1 to 2 inches of water all over the field, the implement is lightly pressed by the handle when it is working. The excess puddle will collect in front and is carried forward and where there is depression the implement is lifted by the handle gently and gradually and the mud will be dropped evenly in the depression as the implement moves. Where the land is already level the implement is allowed to move on without any strain on the handle. One pair of animals can easily cover upto 2 to 3 acres in half day according to the amount of levelling to be done.

If the levelling board is worked every year one can easily dispense with an annual operation in wet land which is called *Kulivettu* over which large sums of money are spent at least once in four or five years over the same piece of land. If the soil should be sandy or very sandy loam it is better the levelling is done with the implement previous to the last ploughing and planting. The idea is such soils may be hardened and it may prevent young roots from easily taking root and the succeeding ploughing will rectify and loosen the soil. This levelling board was tried by several ryots and found to do excellent work. There are now 30 to 40 of them working successfully in Shiyali Taluk.

Agricultural Demonstrator's Office
Shiyali 6—11—40. } Yours etc.
M. Gopala Chetty.

Coffee Control Scheme.

We publish below a Press Note issued by the Government of Madras regarding the Coffee Control Scheme. Ed. M. A. J.

The coffee industry which is concentrated in Madras, Coorg, Mysore, Travancore and Cochin has lost a considerable proportion of its export market as a result of the war. At a meeting of the representatives of all coffee interests, held at Madras in September last, which was attended by the representatives of the Governments and States concerned and the Hon'ble the Commerce Member of the Government of India, an agreed scheme for dealing with the situation was arrived at.

The Central Government have decided to introduce that scheme, as an experimental measure, for the season 1940–41. The Coffee Market Expansion Ordinance, 1940, has been promulgated to give effect to that decision. It comes into effect from December 21, 1940, Sub-section 2 (1) of Section 14 of the Ordinance requires every person owning land planted with coffee plants aggregating not less than 25 acres, whether such land is comprised in one estate or in more than one estate and whether it is wholly or only partly in British India, to apply to the registering officer appointed in this behalf by the Provincial Government to be registered as an owner and in respect of each estate owned by him. Such application has to be made before the expiration of one month from 21st December 1940, the date of commencement of the Ordinance or before the expiration of one month from the date on which after the commencement of the Ordinance he becomes subject to the provisions of sub-section (1) of Section 14 of the Ordinance. The Ordinance empowers the Provincial Government to appoint the registering officer.

The Government have accordingly appointed the Collectors of districts in which the estates are situated as the registering officers in this Province. Every owner of a coffee estate to whom the Ordinance applies should apply for registration to the Collector of the district in which his estate or one of his estates is situated within the time limit prescribed in the Ordinance.

Crop and Trade Reports.

Statistics—Cotton—1940-41--Third forecast report. The average of the areas under cotton in the Madras Province during the five years ending 1938—39 has represented 9·7 per cent of the total area under cotton in India.

2. The area under cotton up to 25th November 1940 is estimated at 1,874 300 acres. When compared with the area of 1,780,300 acres estimated for the corresponding period of last year it reveals an increase of 5·3 per cent.

The area is the same as that of last year in Tanjore and South Kanara. A decrease in area is revealed in Vizagapatam, West Godavari, Kurnool, Nellore South Arcot, North Arcot, Ramnad and Tinnevelly and an increase in area in the other districts of the Province. The variations are marked in Kurnool (–34,000 acres), Bellary (+25,000 acres), Coimbatore (+69,300 acres), Madura (+32,500 acres), Ramnad (–22,200 acres) and Tinnevelly (–17,500 acres).

The area under irrigated cotton, mainly Cambodia, is estimated at 226,300 acres as against 153,800 acres in the corresponding period of last year, thereby representing an increase of 47·1 per cent.

3. Pickings of the *mungari* or early sown crop in parts of the Deccan are in progress and the yield is expected to be slightly below normal.

Normal yields are expected in all the districts outside Tinnevelly. The seasonal factor for the Province as a whole works out to 99 per cent of the average as against 100 per cent in the corresponding period in the previous year. On this basis, the total yield is estimated as 410,400 bales of 400 lb. lint as against 366,800 bales of last year, thereby representing an increase of 11·9 per cent. The crop is young and it is too early to estimate the yield with accuracy.

The estimated area and yield according to varieties are given below:—

(Area in hundreds of acres, i. e., 00 being omitted; yield in hundreds of bales of 400 lb. lint, i. e., 00 being omitted.)

Variety.	Area from 1st April to 25th November		Corresponding yield.	
	1940	1939	1940	1939
1	2	3	4	5
	Acres.	Acres.	Bales.	Bales.
Irrigated Cambodia	212,6	142,8	132,5	89,2
Dry Cambodia	214,7	157 8	46,0	33,6
Total cambodia ...	427,3	300,6	178,5	122,8
Uppam in the Central Districts ...	12,3	20,0	1,9	3,9
Nadam and Bourbon	29,8	22,1	1,5	1,2
Total, Salems ...	42,1	42,1	3,4	5,1
Tinnevellies*	382.7	429,0	94,0	107,3
White and red Northerns	150,0	167,0	18,8	20,9
Westerns	762,0	744,0	95,3	93,0
Warangal and Cocanadas	102 7	90,1	19,5	16,8
Chinnapathi (short staple)	7,5	7,5	9	9

* Includes Karunganni in Coimbatore and Uppam, Karunganni and mixed country cotton in Madura, Ramnad and Tinnevelly.

The local cotton trade is not generally active at this time of the year. The average wholesale price of cotton lint per imperial maund of 82$\frac{2}{7}$ lbs. as reported from important markets on 2nd December 1940 was about Rs. 16—7—0 for Cocanadas, Rs. 18—6—0 for White Northerns, Rs. 18-7-0 for Red Northerns, Rs. 15-6-0 for Westerns (*mungari* crop), Rs. 18—13—0 for Westerns (*jowari* crop), Rs. 30-15-0 for Coimbatore Cambodia, Rs. 26—8—0 for Southern Cambodia, Rs. 28—8—0 for Coimbatore Karunganni, Rs. 24—7—0 for Tinnevelly Karunganni, Rs. 23—15—0 for Tinnevellies and Rs 22—14—0 for Nadam cotton. When compared with the prices published in the last report, i. e., those which prevailed on 4th November 1940, these prices reveal a rise of about 12 per cent. in the case of Southern Cambodia, 7 per cent. in the case of Tinnevellies, 6 per cent. in the case of White Northerns, Coimbatore Cambodia and Tinnevelly Karunganni, 5 per cent. in the case of Cocanadas, 3 per cent. in the case of Westerns (*mungari*) and 2 per cent in the case of Red Northerns, the prices remaining more or less stationary in the case of Westerns (*jowari*), Coimbatore Karunganni and Nadam.

(From the Director of Industries and Commerce.)

Statistics—Crop—Cotton—1940-41—Intermediate condition report. Pickings of the Mungari or early sown crop in parts of the Deccan are nearing completion and the yield is expected to be slightly below normal. In Coimbatore, Madura, Ramnad and Tinnevelly, the growth of the young plants is reported to have been affected to some extent by the heavy and continuous rains of November. The condition of the crop is generally satisfactory elsewhere in the Province.

The average wholesale price of cotton lint per imperial maund of 82$\frac{2}{7}$ lb (equivalent to 3,200 tolas) as reported from important markets on 6th January 1941 was Rs. 14—0—0 for Cocanadas, Rs. 16—12—0 for white Northerns, Rs. 16-7-0 for red Northerns, Rs. 12—14—0 for Westerns (Mungari crop), Rs. 17—12—0 for Westerns (Jowari crop), Rs. 30—13—0 for Coimbatore Combodia, Rs. 27—8—0 for Coimbatore Karunganni, Rs. 24—2—0 for Tinnevelly Karunganni, Rs. 20—13—0 for Tinnevellies and Rs. 21—13—0 for Nadam cotton. When compared with the prices published in the last report i. e., those which prevailed on 2nd December 1940, these prices reveal a fall of approximately 16 per cent in the case of Westerns (Mungari crop), 15 per cent in the case of Cocanadas, 13 per cent in the case of Tinnevellies, 11 per cent in the case of red Northerns, nine per cent in the case of white northerns, six per cent in the case of Western (Jowari crop), five per cent in the case of Nadam, four per cent in the case of Coimbatore Karunganni and one per cent in the case of Tinnevelly Karunganni, the price remaining practically stationary in the case of Coimbatore Cambodia.

(From the Director of Industries and Commerce).

Statistics—Crop—Groundnut—1940—Fourth or final report. The average of the areas under groundnut in the Madras Province during the five years ending 1938—39 has represented 48·6 per cent of the total area under groundnut in India.

The area sown with groundnut in the Province in 1940 is estimated at 3,820,000 acres. When compared with the corresponding estimate of 3,534,200 acres for the previous year and the actual area of 3,617,600 acres according to the Season and Crop Report of the previous year, the present estimate reveals an increase of 8·1 per cent and 5·6 per cent respectively. The estimated area for this year exceeds the average area of 3,415,210 acres by 11·9 per cent.

The increase in area is general outside Vizagapatam, East Godavari, Kistna (−25,300 acres), Guntur (−28,800 acres), Cuddapah, Nellore, South Arcot (−25,100 acres), North Arcot, Tanjore and Ramnad and is marked in Kurnool (−69,800 acres), Bellary (+73,500 acres) Anantapur (+45,200 acres), Salem (+38,400 acres) and Coimbatore (+39,600 acres). The area in the Deccan rose from 1,226,300 acres in 1939—40 to 1,405,000 acres in the current year i. e., by 14·6 per cent.

The harvesting of the summer and early crop of groundnut had concluded by the end of October. The harvesting of the winter or main crop is proceeding.

The crop was affected to some extent by drought in Anantapur, Chittoor, North Arcot and Salem, by heavy rains in Nellore, South Arcot, Trichinopoly, Tanjore and Madura, and by insect pests in parts of Trichinopoly, Tanjore and Madura. The yield is expected to be above normal in Bellary, normal in East Godavari, West Godavari, Kistna and Guntur, Kurnool and Ramnad and below normal in the other districts. The yield is estimated to be low in South Arcot (70 per cent), North Arcot (75 per cent), Chingleput and Tanjore (77 per cent in each). The seasonal factor for the Province as a whole works out to 92 per cent of the average as against 95 per cent in the previous year according to the Season and Crop Report. On this basis, the yield is expected to be 1,760,800 tons of unshelled nuts as against 1,702,680 tons in the previous year, an increase of 3·4 per cent. The yield in an average year is estimated at 1,707,550 tons.

The wholesale price of groundnut (shelled) per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important market centres on 6th January 1941 was Rs. 3—7—0 in Tadpatri, Rs. 3—3—0 in Coimbatore, Rs. 3—2—0 in Vizagapatam, Guntur and Hindupur, Rs. 3—0—0 in Vizianagaram and Cuddalore, Rs. 2—13—0 in Salem, Rs. 2—11—0 in Cuddapah and Vellore, Rs. 2—10—0 in Adoni and Bellary, Rs. 2—8—0 in Nandyal and Rs. 2—7—0 in Guntakal. When compared with the prices published in the last report, i. e., those which prevailed on 4th November 1940, these prices reveal a fall of approximately 27 per cent in Nandyal, 22 per cent in Vellore and Guntakal, 20 per cent in Cuddapah, 18 per cent in Adoni and Bellary, 14 per cent in Vizagapatam, Vizianagaram, Guntur and Cuddalore, 12 per cent in Hindupur, 10 per cent in Salem, eight per cent in Tadpatri and four per cent in Coimbatore.

(From the Director of Industries and Commerce).

Statistics—Crop—Castor—1940—First or final report. The average of the areas under castor in the Madras Province during the five years ending 1938-39 has represented 17·5 per cent of the total area under castor in India.

The area under castor in the Madras Province up to 25th November 1940 is estimated at 2,50,000 acres. When compared with the area of 272,600 acres estimated during the corresponding period of last year, it reveals a decrease of 8·3 per cent. The estimate of last year was greater than the actual area of 266,051 acres by 2·5 per cent.

The crop is mainly grown in Guntur (27,000 acres), the Deccan (121,000 acres), Nellore (38,000 acres) and Salem. As compared with the actual area of last year, a decrease in area is estimated in Guntur, Anantapur (–21,200 acres), and Nellore and an increase in area in the other districts.

The yield is expected to be normal in all districts outside Vizagapatam. The seasonal factor for the Province as a whole is estimated to be 100 per cent of the normal. On this basis, the yield is estimated at 24,900 tons as against 26,800 tons estimated for the corresponding period of last year and 25,630 tons estimated in the season and crop report of last year.

The wholesale price of castor seed per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 16th December 1940 was Rs. 6—4—0 in Vizianagaram, Rs. 6—0—0 in Guntur, Rs. 5—15—0 in Nandyal, Rs. 5—12—0 in Vizagapatam, Rs. 5—8—0 in Cuddapah, Rs. 5—0—0 in Bellary and Anantapur and Rs. 4—10—0 in Hindupur. When compared with the prices reported in the previous year, i. e., those which prevailed on 18th December 1939, these prices reveal a rise of approximately 14 per cent in Vizianagaram, 11 per cent in Anantapur, and ten per cent in Cuddapah and a fall of approximately 14 per cent in Nandyal and nine per cent in Bellary, the price remaining stationary in Hindupur. *(From the Director of Industries and Commerce.)*

Subject:— Statistics—Ginger—1940—Final Report. The area under ginger in 1940 is estimated at 12,000 acres in Malabar and 800 acres in South Kanara as against the actual area of 11,112 acres in Malabar and 800 acres in South Kanara in the previous year.

The condition of the crop is generally satisfactory except in parts of Malabar where the crop is affected by "soft-rot" to some extent. The seasonal factor is estimated at 95 per cent of the normal in Malabar and 100 per cent in South Kanara. On this basis, the yield is estimated at 4,360 tons of dry ginger (4,070 tons in Malabar and 290 tons in South Canara) as against 4290 tons the previous year (4,040 tons in Malabar and 250 tons in South Kanara),

(From the Director of Industries and Commerce).

Statistics—Paddy—1940—41—Intermediate condition report. The main crop of paddy has been or is being harvested in parts of the Circars, the Deccan and the central districts. The yield is reported to be below normal in Vizagapatam and Chittoor: normal in the other districts.

The crop has been affected to some extent by disease in parts of Guntur, by insect pests in parts of Chingleput, North Arcot and Tanjore and by heavy rains in Tanjore. The condiitlon of the crop is generally satisfactory in the other districts.

The wholesale price of paddy, second sort, per imperial maund of 82⅖ lb. (equivalent to 3,200 tolas) as reported from important markets on 6th January 1941 was Rs. 3—8—0 in Madura, Rs. 3—2—0 in Rajahmundry, Ellore, Bezwada, Guntur and Virudhunagar, Rs. 3—1—0 in Cocanada, Masulipatam and Trichinopoly, Rs. 3—0—0 in Vizianagaram and Tinnevelly, Rs. 2—15—0 in Kumbakonam, Rs. 2—14—0 in Hindupur and Chittoor, Rs. 2—13—0 in Nagapatam, Rs. 2—12—0 in Vellore and Anantapur, Rs. 2—7—0 in Cuddalore and Rs. 2—1—0 in Canjeevaram. When compared with the prices published in the last report, i. e., those which prevailed on 9th December 1940, these prices reveal a rise of approximately 19 per cent in Anantapur and two per cent in Kumbakonam and a fall of approximately 18 per cent in Masulipatam, 12 per cent in Ellore and Vellore, 11 per cent in Cocanada, Rajahmundry, Bezwada and Guntur, eight per cent in Trichinopoly, six per cent in Tinnevelly, five per cent in Cuddalore and four per cent in Chittoor, the prices remaining stationary in Vizianagaram, Hindupur, Conjeevaram, Nagapatam, Madura and Virudhunagar.

(From the Director of Industries and Commerce.)

Statistics—Pepper—1940—Final Report. The area under pepper in 1940 in Malabar and South Kanara is estimated at 104,000 acres (95,200 acres in Malabar and 8,000 acres in South Kanara) as against the final area of 104,384 acres (95,599 acres in Malabar and 8,795 acres in South Kanara) in the previous year.

The condition of the crop is generally satisfactory. The seasonal factor is estimated at 100 per cent as against 105 per cent in the previous year. On this basis, the yield is estimated at 9,990 tons (9,140 tons in Malabar and 870 tons in South Kanara) estimated in the previous year.

The wholesale price of pepper per imperial maund of 82⅖ lb. (equivalent to 3,200 tolas as reported from important markets on 6th January 1941 was Rs. 9—14—0 in Calicut. Rs. 9—2—0 in Tellicherry and Rs. 10—2—0 in Mangalore. When compared with the prices published in the last report, i. e., those which prevailed on 9th September 1940, these prices reveal a fall of approximately 12 per cent at Calicut and seven per cent at Tellicherry the price remaining stationary at Mangalore. *(From the Director of Industries and Commerce.)*

Statistics—Crop—Gingelly—1940-41—Third Report. The average of the areas under gingelly in the Madras Province during the five years ending 1938-39 has represented 16·2 per cent of the total area under gingelly in India.

The area sown with gingelly up to 25th December 1940 is estimated at 558,300 acres. When compared with the area of 601,960 acres estimated for the corresponding period of last year, it reveals a decrease of 7·2 per cent. The area estimated for Coimbatore is the highest reported in recent years.

The estimated area is the same as that of last year in West Godavari, Cuddapah and Malabar. An increase in area is estimated in Vizagapatam, East Godavari (plus 13,000 acres). Kurnool, Coimbatore, Trichinopoly and Tinnevelly and a decrease in area in the other districts of the Province, especially in Anantapur (–13,000 acres), Chingleput (–14,000 acres) and Salem (–28,000 acres) owing to want of timely sowing rains.

The main crop has been harvested except in the South. The yield is estimated to be above normal in Kurnool, normal in Vizagapattam, East Godavari, Guntur, Cuddapah, Nellore, Salem, Coimbatore, Ramnad and South Kanara and below normal in the other districts. especially in South Arcot (70 per cent) in Chingleput and Tinnevelly (75 per cent in each).

The seasonal factor for the Province as a whole works out to 94 per cent of the average as against 87 per cent for the corresponding period of last year. On this basis, the yield is estimated at 70,700 tons as against 69,400 tons for the corresponding period of last year, an increase of 1·9 per cent.

The wholesale price of gingelly per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 6th January 1941 was Rs. 6—12—0 in Tinnevelly, Rs. 6—8—0 in Cocanada, Rs. 6—7—0 in Cuddalore, Rs. 6–6—0 in Trichinopoly, Rs. 6—5—0 in Tuticorin, Rs. 6-1-0 in Rajamundry, Rs. 6-0-0 in Vizianagaram, Rs. 5-12-0 in Salem, Rs. 5-8-0 in Vizagapatam, and Rs 5-3-0 in Ellore. When compared with the prices published in the last report, i. e., those which prevailed on 4th November 1940, these prices reveal a rise of approximately 15 per cent in Tuticorin 13 per cent in Cocanada and 7 per cent in Rajamundry and fall of approximately 13 per cent in Ellore, 4 per cent in Vizagapatam, Vizianagaram and Tinnevelly and 3 per cent in Trichinopoly, the prices remaining stationary in Cuddalore and Salem.

(*From the Director of Industries and Commerce.*)

College News and Notes.

Students' Corner:—Students' Club. Under the auspices of the Students' Club Rao Bahadur T. S. Venkataraman, Sugarcane Expert, Imperial Sugarcane Research Station, delivered an inspiring lecture on 23—1—41 on Indian Village and our duty to it, Sri. N. Lakshmanan occupied the chair. The speaker dealt exhaustively on the out-standing problems confronting the present village folk. Recounting some of his personal experiences of the failure of agriculture as a profession the speaker stated that even the best practices of the West should be modified to suit the Indian conditions, if they are to be useful.

On 24—1—41 Mr. A. J. Macdonald, B. Sc., B. Sc. (Agri.) N. D. A., Officer in charge, Poultry Research Section, Imperial Veterinary Research Institute, Izatnagar delivered an educative and thought-provoking lecture on 'Poultry Farming' in India with Sri. K. Unnikrishna Menon in the chair. The speaker deplored the lack of statistics relating to the Poultry Industry in India and gave a short account of the various aspects of poultry work at Izatnagar and the possible lines of development of the Indian Poultry Industry.

College. The College reopened after the Christmas and New year holidays on the 4th January '41. The students of class II proceeded on an educational tour of the Southern districts of the province.

Selection for University Examination. Five students in the first year and one in second year classes were detained from appearance in the University examinations on the score of their unsatisfactory progress revealed in the terminal examinations.

Educational Tour. Starting from Coimbatore on the 3rd of January the second year class reached Tindivanam on the 4th night. The cultivation of oil seed crops and their marketing were the chief subjects of study at this centre. Reaching Palur on the 7th they made studies regarding the cultivation of sugarcane, paddy, groundnut, ragi etc. On the 10th the party visited the sugar factory belonging to Messrs. East India Distilleries and Sugar Factories Ltd. at Nellikuppam. They were shown round the distillery, sugar factory and the confectionery. The party halted at Chidambaram and visited the Annamalai University Colonisation lands. The progress of the much-discussed Colonisation scheme and the enterprise of the graduate Colonists was a matter of great interest to a batch of agricultural graduates in the making. The same night they reached Agricultural Research Station, Aduthurai and in the course of their stay of two days, made a study of the cultivation of paddy, sugarcane, plantains etc. Next day by noon the party paid a visit to a model farm run by Rao Sahib N. S Kolandaiswami Pillai, retired Deputy Director of Agriculture, Trichinopoly. That evening they went to a village and held enquiries about the cultivation of plantains and turmeric. Some of the students took advantage of the proximity of the famous shrine at Srirangam to pay a visit to the place. The 14th day of January dawned on the gay and happy students in Koilpatti. Koilpatti afforded the students scope for the study of the cultivation of cotton, cumbu, cholam, thenai etc., and the opportunity was availed to make some rural enquiries. On the 16th morning the party left the place and reached the great and humming city of Madura by noon where a visit was arranged to the Municipal sewage farm. The glorious sight of the holy Meenakshi Temple and the Thirumalainayakan palace, made a great impression on the young minds. The party returned to Coimbatore on the 17th afternoon.

The students played a badminton match at Tindivanam and lost in a keen contest. At Koilpatti they played a volley ball match against the local high school team and had an easy victory. The party was led by Sri. K. Unnikrishna Menon, Senior Lecturer in Agriculture and Sri. P. A. Venkateswaran, Senior Teaching Assistant.

Games:— Football. In the inter-tutorial foot-ball match played in connection with the club day activities Mr. K. M. Thomas' wards defeated Mr. P. V. Ramiah's wards by 3 goals to 1 and Sri. C. R. Srinivasa Ayyangar's wards won over Sri. C. N. Narasimha Ayyangar's by 2 to 1.

Hockey. In the inter-class tournament played for the Victory cup the match between 1st and 3rd year classes ended in a draw on the first day, but in the replay the third year class defeated their enthusiastic juniors by 4 goals to 1.

New Year Honours. It is gratifying to note that the title of K. C. S. I. was awarded to Sir. C. P. Ramaswami Ayyar, Dewan of Travancore and a Patron of the Madras Agricultural Students' Union and that the title of Rao Bahadur was conferred on Sri. K. T. Alwa, Headquarters Deputy Director of Agriculture, Madras. We offer our congratulations to these friends of the Union on their well-merited distinctions.

Visitors. Mr. P. H. Rama Reddy, Director of Agriculture, Madras, Mr. T. J. Hurley, Director of Veterinary Services, Madras, Mr. M. J. Narasimham, Deputy Director of Agriculture, Mysore state, Mr. J. B. Polding Esq., Research Officer on contagious abortion, Imperial Veterinary Institute, Mukteswar, and Mr. M. J. Macdonald, Officer in charge, Poultry Research section, Imperial Veterinary Institute, Izatnagar, were among the visitors to the Agricultural College and Research Institute during the month.

Association of Economic Biologists, Coimbatore. At a meeting of the association held on the 20th December 1940, Rao Bahadur M. R. Ramaswami Sivan, Retired Principal, Agricultural College gave a lecture on 'The Anand Institute'. This was followed by a paper by Rao Bahadur G. N. Rangaswami Ayyangar and V. Achuta Wariar on "The little Millet, *Pancum miliare*."

First aid Training. The training class for the benefit of the College Estate residents under the auspices of the St. John's Ambulance Association was inaugurated on the 22nd January 1941. The first class was held on the 26th January at which over fifty residents of the estate attended. We are grateful to the Coimbatore branch of the Ambulance Association and Dr. P. R. Kuppuswami for arranging the classes to be held at the College.

New Year's Day War Victory Celebration. The Agricultural College and Research Institute Estate celebrated New Year's Day in three meetings held in three different places—north, centre and south of the Estate area. Meetings were held at the Millets Breeding Station (North), the Central Farm (Centre), and the Paddy Breeding Station (South). All the labourers were assembled along with the villagers of the surrounding hamlets. After due publicity large gatherings were held, and the success over the Italians was explained to them. They were given an insight into the harrowing conditions of the War areas and of the peace and security enjoyed by us, under the protection of the strong arm of Britain. The villagers were made to realise the necessity for making liberal contributions towards this War effort. At the end of the meetings, sweets were distributed to the children,

OBITUARY

We regret to record the sad demise of Sri. P. Parthasarathy, B. Sc. Ag. on the night of 25th December at the early age of 33. He passed out of the Agricultural College, Coimbatore in 1933 and joined the Department first at Kodur. In recognition of his experience in fruit research work he was recently posted to Guntur for developing the newly started orchard at this place. He took ill recently and passed away in spite of the best medical help. He was a capable and enthusiastic young man and in his death the Department loses a very promising officer. He leaves behind him his young widow, aged mother, several relations and a host of friends to bemoan his loss.

Moffussil News.

Agricultural Exhibition at Tiruvannamalai. An Exhibition stall was opened in the Fourth All India Swadeshi Exhibition held at Tiruvannamalai, on the occasion of the *Karthigai Deepam* Festival, from the 5th to the 16th. The Exhibition Committee afforded all facilities for arranging the stall. The exhibits were arranged into eight sections, comprising of seeds and crops, implements, manure preservation, horticulture, cream jaggery making, malt making, insect pests and diseases and bee-keeping. The exhibits in each section were arranged tastefully and supplemented with coloured pictorial and word posters. The Coimbatore strains of paddy and the ground-nut specimens of seeds and plants from Tindivanam Research station elicited many inquiries. The horticultural exhibits included fruit plants from Kodur, fruit research station, fruits from Coonoor, posters illustrating care and management of citrus gardens and preserves which demonstrated the possibility of the utilisation of surplus fruit. Considerable interest was evinced in all these exhibits. Malt making which was demonstrated as a practicable cottage industry was appreciated by many visitors. The section dealing with insect pests and diseases with control measures elicited nearly 64

inquiries from persons coming from different districts. Bee-keeping exhibits effectively kept a crowd of interested people always about them. Honey and wax produced from the Haji Apiaries, Vaniambadi, were sold during the period and there was a large demand for more honey.

The Exhibition was opened by the Revenue Divisional Officer, Tiruvannamalai, Sri. M. P. Narayanan Nair. The committee of judges awarded a Gold medal certificate to the Department. A. R.

Denkanikottai Rural Exhibition. A Rural Agricultural Exhibition was organised under the auspices of the Village Uplift Sangham, Denkanikottai, Hosur taluk, Salem. The Exhibition attracted considerable interest from all the surrounding villages. There was keen competition amongst the exhibitors for the prizes. Besides exhibits kept in the stall crops were judged in situ in the fields. The Department exhibited improved strains of seeds and iron implements for various agricultural operations suited to the locality. The exhibits were judged by the Sub-Collector, Hosur and prizes in the form of Seeds, Implements and Manures were awarded to the best exhibits. A. R.

Weather Review—DECEMBER 1940.

RAINFALL DATA

Division	Station.	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	−0·7	72·1	South	Negapatam	18·1	+6·7	76·3
	Calingapatam	0·0	−0·7	45·9		Aduthurai *	5 6	−2·5	50·3
	Vizagapatam	0·7	0·0	34·6		Madura	1·9	+0·1	44·6
	Anakapalli*	0·0	0·0	0·0		Pamban	4·1	−3·4	48·4
	Samalkota*					Koilpatti*	5·8	+3·1	44·2
	Maruteru*	0·0	−0·3	40·6		Palamkottah	7·9	+3·9	33·7
	Cocanada	0·0	−0·9	46·0					
	Masulipatam	0·2	−0·7	41·2					
	Guntur*	1·1	+0·2	34·3	West Coast	Trivandrum	5·2	0·0	71·8
						Cochin	2·7	+1·0	132·1
Ceded Dists.	Kurnool	0·0	−0·2	29·1		Calicut	0·0	−1·1	128·8
	Nandyal*	1·4	+1·3	24·3		Pattambi *	1·0	+0·2	99·0
	Hagari *	0·2	+0·1	22·0		Taliparamba *	0·2	−0·5	149·1
	Siruguppa*	0·1	0·0	24·5		Kasargode *	0·7	−0·1	152·5
	Bellary	0·1	0·0	22·1		Nileshwar*	0·5	−0·2	157·3
	Anantapur	0·0	−0·3	27·3		Mangalore	0·6	+0·1	150·3
	Rentachintala	0·7		27·4					
	Cuddapah	0·0	−0·9	39 9					
					Mysore and Coorg	Chitaldrug	0·1	−0·2	34·0
	Anantharaju-pet*	0 9	−0 7	50·4		Bangalore	0·6	+0·1	36·5
Carnatic	Nellore	1·6	−1·6	55·2		Mysore	0·9	+0·5	48·4
	Madras	5 6	−0 2	52·2		Mercara	0·6	−0·1	143·0
	Palur*	10·4	+3·4	69 9					
	Tindivanam *	4·2	0·0	47·9	Hills	Kodaikanal	1·6	−2·8	73·4
	Cuddalore	7·8	+0·6	77·3		Coonoor			
Central	Vellore	1·4	−1·3	37·2		Ootacamund *	1·3	+0·1	53·7
	Salem	0·4	−0·6	39·7		Nanjanad *	1·0	−0·7	52·4
	Coimbatore	3·3	+2·1	40·9					
	Coimbatore A. C. & R. I.*	3·3	+1·8	33·7					
	Trichinopoly	2·4	−0·2	36·7					

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated up to 1937 (published in Fort St. George Gazette).

The weather during the first three days of the month was generally dry over the whole area. But from the 4th till the 6th and again between the 11th and 14th the trough of low pressure over the south of the Bay was again active as in the month of November and occasioned widespread and locally heavy rain in the South East of the peninsula. On the 15th of the month conditions were unsettled in the south of the Bay but failed to develop into a depression. Conditions were again unsettled in the South East of the Bay on the 20th, and developing into a depression on the next day moved north east and crossed the North Burma coast by the 23rd. Thereafter conditions were more settled and weather dry with a tendency for falling temperatures over South India.

Rainfall was in large excess locally in the Coromandel Coast, and in the Central Districts and normal or in defect elsewhere.

Other climatic elements were nearly normal. The chief falls reported were:

Panruti	(South Arcot)	8·1"	(4th)
Chidambaram	(do.)	6·7"	(,,)
Tiruchendur	(do.)	6·1"	(,,)
Vridhachalam	(do.)	6·2"	(5th)
Cuddalore	(do.)	5·7"	(4th)
Porto Nova	(do.)	5·6"	(5th)
Negapatam	(Tanjore)	5·3"	(6th)

Note on the total rainfall for 1940. The rainfall for the twelve months of the calendar year 1940 was characterised by its being in very large excess over the whole presidency with the exception of parts of the Ceded districts and the Nilgiri hills.

The first three months of the year were generally dry except for locally heavy rainfall in the northern districts due to the effect of secondary low pressure areas derived from western disturbances traversing the upper part of the peninsula.

During the hot weather months of April and May rainfall was generally in excess owing to thunderstorm activity during April and with the formation of a depression in the Bay which stimulated a temporary advance of the monsoon in May, when heavy rainfall occurred in the Circars.

The monsoon set in over the peninsula early in June and continued strong during July and August. During these months rainfall was in excess in Malabar coast and in the Circars. The rainfall was generally below normal everywhere during September and ontside the Ceded districts in October, but in November the weather over the south was continuously unsettled and rainfall in large excess, these unsettled conditions extended till the middle of December and rainfall was again heavy in the south during that period.

The annual rainfall was in large excess over the whole of the presidency outside parts of the Ceded districts and Nilgiris and most markedly so in the Ganjam district of Orissa, and on the Coromandel Coast and in parts of the Central districts, West Coast and Mysore.

Weather Report for the Agricultural College and Research Institute Observatory:

Report No. 12/40.

Absolute maximum in shade	89°F
Absolute minimum in shade	58·0°F
Mean maximum in shade	83·1°F
Departure from normal	−0·7°F
Mean minimum in shade	66·0°F
Departure from normal	+0·9°F
Total rainfall for the month	3·29"

Departure from normal	... ...	+1·8″
Heaviest fall in 24 hours	... ...	1·40″
Total number of rainy days	... ...	6
Mean daily wind velocity	... ...	1·23 m. p. h.
Departure from normal	... ...	−1·73
Mean humidity at 8 hours	... ...	78%
Departure from normal	... ...	−0·8%

Summary. Under the influence of unsettled weather, rainfall was in large excess. Skies were generally moderately clouded. Day and night temperatures were nearly normal.

P. V. R. & R. S.

Departmental Notifications.

Gazette Notification.

Transfers.

Name of officers.	From	To
Sri. U. Vittal Rao,	Offg. Asst. Marketing Officer, Madras,	Offg. Asst. D. A., Tellicherry.
„ G. Ganapathi Ayyar,	Asst. in Chemistry, Agri. Res. Inst. Coimbatore,	Offg. Asst. Agri. Chemist in charge of the Agri. Res. Station, Siruguppa.

Leave.

Name of officers.	Period of leave.
Sri. K. T. Alwa, Headquarters Dy. Director of Agriculture, Madras.	L. a. p, for 4 months from 16-2-41 preparatory to retirement.
„ C. V. Ramaswami Ayyar, Asst. Agri. Chemist. A. R. S. Siruguppa.	L. a. p, for 2 months and 26 days with effect from the date of relief.

Subordinate Services.

Transfers.

Name of officers.	From	To
Sri. R. Narasimha Ayyar,	A. D. in Mycology St. Thomas Mount,	Mycology section, Coimbatore,
Mr. Herbert Adiseshaiah,	A. D. Vellore,	Sugarcane Research Station, Gudiyattam.
„ S. D. S. Albuquerque,	Botanical Asst., A. R. S. Pilicode,	A. R. S. Neleswar III.
„ S. V. Kuppuswami,	Asst. in Chemistry, A. R. S. Siruguppa,	Asst. in Chemistry Section, Coimbatore.
Sri. E. Kunhappa Nambiar,	Upper Subordinate (on leave)	F. M. Taliparamba.
Janab Soopi Hajee	Asst. F. M. Taliparamba	Asst. A. D. Manjeri.
Sri. C. Raman Moosad,	A. D., Manjeri,	A. D., Wallajah.
„ M. A. Balakrishna Iyer,	A. D. Wallajah,	A. D., Vellore.
„ S. P. Fernando,	Asst. A. D. (on leave),	A. D. Ramnad.
„ A. B. Adisesha Reddy,	A. D. (on leave),	A. D., Guntakal.
„ M. Vaidyanathan,	A. D. Guntakal,	A. D., Rayadrug.

Leave.

Name of officers.	Period of leave.
Sri. M. S. Kylasam, Asst. to the Entomologist, Coimbatore.	L. a. p. for 30 days from 30-1-41.
„ S. Madhava Rao, F. M. Central Farm, Coimbatore.	Extension of l. a. p. for 28 days from 12-1-1941.
„ A. Shanmugasundaram, A. D., Pattukottai.	L. a. p. for 25 days from 16-1-41.
„ K. Hanumantha Rao, A. R. S., Pattambi.	L. a. p. for 49 days from 20-1-41.
„ D. S. Subramania Ayyar, A. D., (on leave).	Extension of l. a. p. on m. c. for 6 weeks from 24-12-40.
„ M. Vaidyanathan, A. D., Guntakal.	L. a. p. for 3 months and 15 days from 15-1-41.
„ G. Venkataramana, A. D., Bapatla.	Extension of leave on half average pay on m. c. for 1 month from 24-12-40.
„ M. Bhavani Shanker Rao, Asst. Groundnut scheme, A. R. S., Tindivanam.	Earned leave for 30 days from 6-1-41.
„ L Krishnan, A, D.. Tanjore	Extension of l. a. p. on m. c. for 6 weeks from 9-1-41.
„ V. Achyutharamiah, A. D., Jami.	Extension of l. a. p. on m. c. for 6 weeks.
„ K. Sreeraman, Asst. in Chemistry, A. R. S., Siruguppa.	L. a. p. for 29 days from 3-1-41.
„ C. K. Ramachandran, Asst. in Cotton, D. F. S., Hagari.	L. a. p. for 30 days from 3-1-41.
„ N. Ranganathachari, A. D., Dhone.	Extension of l. a. p. for 1 month on m. c from 19-12-40.
„ V. Ratnajirao, A. D,, (on leave).	L. a. p. for 4 months with m. c from 16-12-40.
„ C. S. Gopalaswami Rao, Mycology Asst. Bellary.	L. a. p. for on m. c. for 2 months from 7-1-41.
„ Raman Moosad, A. D , Manjeri.	L. a. p. for 1 month from the date of relief.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during the quarter ending 31st December 1940.

A. Books.

1. *Elementary Lessons in Agriculture in Telugu.* Jogi Raju, G. (1940). 2. *'Pandlu' — Fruits Part I — General in Telugu.* Jogi Raju, G. (1936). 3. *'Pandlu'— Fruits Part II — Mango in Telugu.* Jogi Raju, G. (1940). 4. *Elementary Agriculture.* Mitra, S. K. (1940). 5. *Sarola Kasar: Study of a Deccan Village in the Famine Zone.* Jagalpure, L. B. & Kale, K. D. (1938). 6. *Price Fixing by Government in Foreign Countries, 1926-1939 - A selected list of references.* Hannay, A. M. (1940). 7. *Agricultural Produce Act, 1937 with rules made prior to 31st August 1940.* Government of India Publication. (1940). 8. *Report on the marketing of Grapes in India*

& Burma – Marketing Series No. 20. Government of India Publication. (1940). 9. *Report on the marketing of Coffee in India & Burma – Marketing Series No. 121.* Government of India Publication. (1940), 10. *Report of the Committee on Co-operation in Madras – 1939–40.* 11. *Planting Directory of Southern India.* U. P. A. S. I. Publication. (1940). 12. *Plant Physiology – A Text Book for College & Universities.* Meyer, B. S. and Anderson, D B. (1940). 13. *Colorimetric methods of Analysis – Volume II – Organic and Biological.* Snell, F. D. & Snell, C. T. (1937). 14. *Diptera – Volume VI – Family Calliphoridae (Fauna of British India Series).* White, R. S. & others. (1940). 15. *Records and Research in Engineering and Industrial Science.* Holmstrom, J. E. (1940), 16. *Utilization of Indian Vegetable Oils and Lubricants in Internal Combustion Engines.* Aggarwal, J. S. and Verman, L. C. (1940). 17. *Broadcasting in India – The first Report (1938–39) of the office of the Controller of Broadcasting.* Government of India Publication, (1940).

B. Annual Reports of The Agricultural Department etc.

1. Proceedings of the Association of Economic Biologists, Coimbatore. (1938). 2. Administration Report of the Madras Electricity Department for the year 1939–40. 3. Annual Report of the Mysore Agricultural Department for 1938–39. 4. Report on the Administration of the Meteorological Department of the Government of India in 1939–40. 5. Annual Report of the Agricultural Meteorology Section, Indian Meterological Department for 1938–39. 6. Proceedings of the 29th meeting of Advisory Board of the Imperial Council of Agricultural Research. 1940. 7. Administration Report of the Baluchistan Agency for 1938–39. 8. Annual Administration Report of the Department of Agriculture–United Provinces for 1938–39. 9. Annual Report of the Department of Agriculture–Baroda State–for 1938–39. 10. Report on the Experimental Farms in the Central Provinces and Berar–for 1938–39. 11. Proceedings of the Indian Society of Soil Science, 1939–40. 12. Report on the operations of the department of Agriculture, Burma for 1939-40. 13. Report of the Agricultural Stations in Burma for 1939–40 14. Annual Report of the Grain Research Laboratory, Winnipeg, Manitoba, Canada for 1939. 15. Annual Report of the Department of Agriculture, Malaya for the year 1939. 16. Canadian Seed Growers' Association–Annual Report, 1937–38. 17. Report of the Department of Agriculture—British Honduras–1939. 18. Cornell University Agricultural Experiment Station-Annual Report for 1939. 19. Annual Report of the Iowa Agricultural Experiment Station for 1938–39 20. Annual Report of the Iowa Corn Research Institute for 1938–39. 21. Transaction of the Iowa State Horticultural Society for the year 1939 22. Annual Report of the Nebraska Agricultural Experiment Station for 1939. 23. Annual Report of the Ohio Agricultural Experiment Station for 1937–38.

New Periodicals

Report on the Seaborne Trade of the Province of Madras for the year 1939–40.

The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

Vol. XXIX] FEBRUARY 1941 [No. 2.

EDITORIAL

Employ the Agricultural Graduate. Agriculture as a pursuit for the betterment of human happiness has developed remarkably from the days when primitive man learnt to scatter around his jungle abode the seeds of his favourite food plant and waited for the time when he could gather and store the produce against a rainy day. The history of the development of Agriculture from the primitive methods to the most modern scientific practices is a tale of romance, adventure and research through which man has unravelled several fundamental secrets of nature and gradually harnessed them to his advantage. Today human achievements in the field of scientific agriculture provide the world with food, drink, shelter, clothing, drugs, spices, dyes, narcotics, fertilizers, vitamins and a host of other materials necessary for sustaining life and making that life worth living. Embracing as it does something of every aspect of human knowledge, scientific agriculture is to-day a compendium of specialised knowledge in several sciences which contribute to human welfare. Consequently the importance of agricultural education in countries which are predominantly agricultural can never be over-estimated. Even in countries which are highly industrialised, the importance of agriculture and agricultural industries becomes acutely felt during a period of crisis. The current slogan "ploughing for victory" in countries like Great Britain is an instance in point. It is for this reason that civilized countries all the world over, establish agricultural colleges and impart agricultural education to its young men (and women). The establishment of an agricultural college involves a great outlay in money. Besides the usual buildings, grounds and equipment necessary for ordinary educational institutions, an agricultural college requires the maintenance of an extensive farm representing different types of soils, with its concomitant adjuncts like crop-breeding stations, cattle yards, dairy, veterinary hospital, engineering workshops, meteriological stations, botanical gardens, green houses, insectary, pumping plants, silos and sewage disposal plants, in addition to expensively equipped laboratories for the study of pure sciences. Agricultural education is consequently immensely more expensive than other professional studies and for this reason agricultural colleges in India as elsewhere, are maintained by the state as a national investment which is calculated to repay the outlay several-fold in the shape of national prosperity. Time there

was, when the products of agricultural colleges in India were all absorbed as rapidly as they were produced, for service in the growing agricultural departments. Other departments of Government and the big land-lords were then deprived of their services. Conditions have changed since. The Agricultural graduate with his diversified knowledge of rural conditions and his unique training for catering to the needs of the people, still remains a potential asset to the revenue, Educational and co-operative departments and better fitted for his job than his comrades emerging from other educational institutions. For the simple reason that his services were in greater need in one particular department in the earlier days of agricultural education, the door to other departments is slammed against him. To us it appears to be a travesty of economy that the heavy investment which the state made in producing a national asset to the country is let drift into a national loss. So much for the state. There is another class of employers to whom a unique opportunity offers itself today for the employment of the agricultural graduate. The European planting community in South India which is ever alive to the importance of scientific agriculture, the Zamindars and the big land lords in the country are perhaps unaware of the availability of these fully trained men for employment. The few men who took up service under these agencies have won laurels in their own line. We trust that these employers especially the planting community will avail themselves of the opportunity at a time when their ranks are sadly depleted by the demands of the state for war service.

A Quantitative Method of Determining Pith-Formation in Sugarcane.

By K. VENKATARAMAN, M. A.
Superintendent, Agricultural Research Station, Anakapalle.

and

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Introduction. All sugarcane growers are aware of the occurrence of pith in some sugarcane varieties. The pith usually commences from the central region of the sugarcane. Histologically, pith-formation proceeds by the loss of cell-sap and drying up of the innermost tissue of the central cylinder, and the magnitude of pith formed varies from a central streak or fistular strand to the entire region becoming dry and corky. The natural causes of pith-formation are believed to be either varietal or due to deterioration-phases commonly attendant on over-maturity. In any case, it is of primary importance to the sugarcane grower to know when pith-formation forms in a particular variety, and how far it develops with time, to enable the choice of the right variety and to fix upon the most beneficial time of harvest. Moreover, pith-formation is an economic loss to the grower, as it saps the juice and reduces cane-weight resulting in the loss of cane tonnage. A study of the commencement and relative progress of pith formation in different varieties of sugarcane is of great value in preventing loss of cane out-turn, a factor of vital interest to the grower. So far the only method of estimating pith-formation consisted in cutting open the cane, and examining the longitudinal and transverse sections for pith formed. Such qualitative observations, although affording a clue, could never be so precise or exact as quantitative determinations. The enunciation of a suitable quantitative technique engaged the serious attention of the senior author of this paper, and the method of density determinations described hereunder, proved to be a reliable means of estimating the relative degrees of pith formation in canes. As a natural consequence of pith formation the cane becomes light, and the volume remaining the same, the density is consequently lowered.

Methods and details of density study in sugarcane. Density was determined by the cutting and removal of a certain fixed internode of a cane, weighing it in a sensitive balance, and finding its volume by displacement in a graduated jar, and arriving at the weight per unit volume. The internodes were always cut at two distinct marks. The leaf insertion region formed one end of the internode, and the growth ring marked the other. The position of the cane at which the internode is cut is a point of importance. Generally pith formation is found to be more at the top half of canes than at the bottom. In the present study, the internodes were cut

at one-fourth the length of the cane from the top, one-fourth the length of the cane from the bottom and the respective densities determined. The actual pith-formation in the internode as observed when cut open was also recorded in all cases in order to see how far the quantitative density-determinations, supported the visual observations.

As generally pith is associated with canes left to stand on the field after maturity, the density studies were confined to the late varieties and the results are embodied in Table I. The recorded observations on each variety on both 'arrowed' and 'unarrowed' canes were made on the same date. The readings given in the table are the average of two canes.

The figures in Table I disclose that the density of the top internode of Co. 349 'arrowed' which was full of pith, was the least. The density was also equally low in tops of Co. 331 and Co. 417 'arrowed' which were fully pithy. The bottom internodes of all varieties except Co. 408, and tops of 'unarrowed' canes, which contained little or no pith, always showed high densities above unity. Co. 408 'unarrowed' bottom which had a low density of 0·886 contained large amount of pith. A positive correlation between the density of a cane and its pith formation appeared therefore to clearly exist. However for further and fuller confirmation of this indication densities of numerous samples in each variety were recorded, and the extent of the deviations from their means, and the significance of the differences between means worked out. The results are embodied in Table II.

Differences between means of columns 2 and 4 (Table II) were not significant, and the pith formation as observed was also very little in both. Differences between means of columns 1 and 3 were highly significant and the pith formation as observed was also much greater in 1 than in 3. Differences between means of columns 3 and 5 were not significant and the pith formation was more or less the same in both. Again the differences between means of columns 5 and 7 were not significant and the pith formation in both was very little.

The standard deviations or the dispersion of the population from the mean, and the coefficient of variations were small showing that the densities at a particular part of the cane are more or less uniform.

It is therefore established that the density determination is a reliable measure of pith-formation in canes, and consequently to compare the relative pith-formation between varieties it would be quite enough to find the densities of internodes at some fixed part of the cane. But the part of the cane selected must be so judiciously chosen as to give a correct index of its pithiness. Table III gives figures of the density of every internode from top to bottom of Co. 331 'arrowed' and 'unarrowed' cane respectively.

A scrutiny of figures in Table III shows that pith-formation is most in top-half of the cane and least at the bottom-half. It will be undoubtedly ideal to find the density of the whole cane in all cases but such a procedure

TABLE I.

Densities and pith formation of some late varieties.

Date of planting 26—2—39. Date of observation 25, 26—4—40

Serial No.	Variety.	Arrowed canes.				Unarrowd canes.			
		Top internode.		Bottom internode.		Top internode.		Bottom internode.	
		Density.	Pith as observed.	Density.	Pith as observed.	Density.	Pith as observed.	Density.	Pith as observed.
1	Co. 419	0·918	$\frac{1}{3}$ to $\frac{1}{2}$ diameter pithy	1·066	No pith	1·067	Very slight	1·070	No pith
2	Co. 417	0·881	Very much pithy	1·049	Very slight	1·042	Small core forming	1·066	Very slight
3	Co. 416	...	Not arrowed	...	Not arrowed.	1·028	No pith	1·059	No pith
4	Co. 413	0·948	$\frac{1}{3}$ to $\frac{1}{2}$ diameter pithy	1·057	No pith	1·069	Very little pith	1·072	Do.
5	Co. 411	0·989	$\frac{1}{2}$ diameter ,,	1·081	Little pith	1·071	Slight	1·056	Small central core
6	Co. 408	0·943	More than $\frac{1}{2}$ diameter pithy	1·065	$\frac{1}{2}$ diameter pithy	1·063	Small central core	0·886	$\frac{1}{4}$ to $\frac{1}{2}$ diameter pithy
7	Co. 349	0·852	Full of pith	0·939	$\frac{1}{3}$,, ,,	1·072	Small core of pith	1·082	Small core of pith
8	Co. 331	0·858	Very much pithy	1·027	Small core of pith	1·049	Do.	1·050	Do.
9	J. 247	...	Not arrowed.	...	Not arrowed	1·010	Central core of pith	0·977	$\frac{1}{3}$ diameter pithy

will entail enormous time and labour. Hence some position, say ¼th or ½ the length of the cane from the top can be taken for determining density.

Summary and conclusion. (i) Density determination is found to be a reliable measure of pith formation in canes, and the full technique is described in detail with illustrative figures.

(ii) The internode, say at one-fourth or one-half of the length of the cane from the top can be cut, always at some fixed marks, viz. the leaf-insertion region, and the growth ring, and the density determined.

(iii) It is always best to record the pith-formation as actually observed by splitting open the cane against its density. The one gives a visual indication, while the other is an exact measure of pith-formation.

TABLE II

Densities of certain varieties, their means, and standard deviations.

Serial No.	Co 331 arrowed		Co 331 unarrowed		Co 417 unarrowed		Co 419 unarrowed	
	Top 1	Bottom 2	Top 3	Bottom 4	Top 5	Bottom 6	Top 7	Bottom 8
1	0·902	1·035	0·863	1·021	1·031	1·058	1·055	1·065
2	0·881	1·023	0·884	1·009	1·021	1·030	1·038	1·027
3	0·879	1·017	1·008	0·987	1·035	1·010	1·077	1·068
4	0·876	1·038	0·995	1·050	1·017	1·043	1·055	1·049
5	0·861	1·016	1·044	1·013	1·046	1·043	1·062	1·069
6	0·887	1·014	1·049	1·023	1·036	1·038	1·048	1·051
7	0·880	1·054	1·051	1·038	1·043	1·036	1·071	1·062
8	0·866	1·050	1·052	0·999	1·025	1·061	1·066	1·039
9	0·823	1·028	0·989	1·026	1·002	1·040	1·056	1·037
10	0·889	1·037	0·962	1·062	1·030	1·058	1·075	1·073
11	0·818	1·026	0·888	1·035	1·039	1·045	1·045	1·012
12	0·878	1·052	1·001	0·999	1·027	1·025	1·066	1·058
13	0·842	1·033	1·048	1·052	0·982	1·056	1·075	1·030
14	0·828	1·007	1·016	1·044	1·043	1·042	1·030	1·009
15	—	—	1·023	0·989	1·013	1·044	1·061	1·042
M. N.	0·865	1·031	0·992	1·023	1·026	1·042	1·059	1·046
S. D.	0·0257	0·0142	0·0544	0·0282	0·0166	0·0058	0·0127	0·0229
C. V.	2·971	1·377	5·484	2·757	1·616	0·559	1·199	2·190
Pith formation	two-thirds to whole core thickness.	Very small central core of pith.	Varying from a small central core to ¾ diameter	Small central core.	Very small central core to ¼th diameter.	Very small central core.	Very small central core.	Very small central core.

TABLE III

Density of every internode of Co. 331 (one entire cane from the top to bottom).

Date of planting 22—2—39 Date of observation 18—5—40

Co. 331 arrowed			Co. 331 unarrowed		
Inter-node No.	Density	Pith as observed	Inter-node No.	Density	Pith as observed
1	0·688	Completely pithy	1	0·981	$\frac{1}{3}$ diameter pith
2	0·769	Full of pith	2	0·981	$\frac{2}{3}$,, ,,
3	0·810	Nearly full of pith	3	0·950	do.
4	0·825	More than $\frac{3}{4}$ diameter pithy	4	0·966	$\frac{3}{4}$ diameter pith
5	0·902	$\frac{2}{3}$ diameter pithy	5	0·940	Nearly $\frac{1}{2}$ diameter pith
6	0·935	$\frac{1}{2}$,, ,,	6	0·886	$\frac{3}{4}$ diameter pith
7	0·961	do.	7	0·884	do.
8	0·959	do.	8	0·846	Nearly $\frac{3}{4}$ diameter pith
9	1·018	Small central core	9	0·890	Slightly more than $\frac{2}{3}$ diameter
10	1·034	do.	10	0·968	$\frac{2}{3}$ diameter pith
11	1·035	do.	11	0·966	$\frac{1}{3}$,, ,,
12	1·027	do.	12	0·970	do.
13	1·026	do.	13	1·028	$\frac{1}{6}$,, ,,
14	1·047	do.	14	1·024	Small central core
15	1·041	do.	15	1·009	$\frac{1}{4}$ diameter pithy
16			16	1·008	Small central core
17			17	1·020	do.
18			18	1·014	do.
19			19	1·026	do.
20			20	1·053	Very small central core

Rotation and Mixed Crops with Sorghum.

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Introduction. Sorghum is the chief cereal crop grown under rain-fed conditions in the Madras Presidency. It is grown on an area of more than $4\frac{1}{2}$ million acres. It is usually grown in rotation with the commercial crops—cotton, groundnut (*Arachis hypogea,* L.), tobacco or chillies (*Capsicum* spp.). A pulse crop like red gram (*Cajanus cajan,* (L) Millsp.) or Bengal gram (*Cicer arietinum,* L.) is grown in rotation with it in some parts of the presidency. These as well as other pulses are often grown mixed with sorghum, thereby saving land, labour and cultivation expenses, and obtaining a variety of produce. The crops grown mixed with sorghum and in rotation with it depend upon the nature of the soil and season, and the local conditions and demand. Irrigated sorghum is usually grown as a pure crop.

Information on rotation and crops mixed with sorghum was obtained from different parts of the presidency, and the data gathered is summarised in this paper. Considering the soil and seasonal conditions and agricultural practices the presidency can be roughly divided into eight regions, the agricultural practices in each of which being more or less similar for the region. In the districts of Chingleput, Tanjore, Malabar, S. Canara and Nilgiris the area of sorghum is negligible, and hence the practices in these districts are not recorded here.

Agricultural practices. In the three northern districts of Vizagapatam and East and West Godavari sorghum is a minor crop, except on the uplands bordering the Eastern ghats. The total area of sorghum in the three districts is about 240,000 acres. There are two seasons in which sorghum is grown: *punasa* (June to September) and *pyru* (September to January). In the *punasa* season, *Konda Jonna* or *Tella Jonna* (*Talaivirichan cholam* type) and in the *pyru* season *Patcha Jonna* (yellow grain) is grown. The *Patcha Jonna* is also grown in the high level lands bordering the Godavari river and its deltaic branches, subject to flooding during the South West Monsoon. These lands are known as *lankas* and are very fertile. In these the chief crop is tobacco, sorghum being grown only occasionally. In parts of the Vizagapatam district sorghum seedlings are transplanted in rain-fed lands. The seedlings are dropped in plough furrows, the succeeding furrow covering up the previous one and thus planting up the seedlings dropped.

No regular rotation is practised near the hills. Sorghum and other millets mixed with pulses, oil seeds and sometimes rice also, are grown according to the time and nature of rains. Lands under cultivation for two or three years are often left fallow for five or six years before they are cultivated again. This is common in the Agency tracts. In places where cultivation is more advanced, short duration millets like *tenai* (*Setaria italica*, Beauv.), *samai* (*Panicum miliare*, Lamk) or *cumbu* (*Pennisetum typhoides*, Stapf and Hubbard) mixed with gingelly (*Sesamum orientale*, L.) and pulses or groundnut are grown in the *punasa* season and *Patcha Jonna* in the *pyru* season.

In the areas lower down, especially in the *lankas* of the East Godavari district, tobacco and chillies are grown in rotation with sorghum. In some places cotton or *ragi* (*Eleusine coracana*, Gaertn.) is rotated with sorghum in black soil areas. In this area sorghum is usually grown as a mixed crop. The crops usually mixed with it are pulses—red gram, lablab, (*Dolichos lablab*, L.), cowpea (*Vigna unguiculata*, (L.) Walp.), green gram (*Phaseolus aureus*, Roxb.), black gram (*Phaseolus mungo*, L.), horsegram (*Dolichos biflorus*, L.), and *tegapesara* (*Phaseolus* Sp.), oil seeds—gingelly, and fibres—sunnhemp (*Crotalaria juncea*, L.) and *gogu* (*Hibiscus cannabinus*, L.); shorter duration cereals—rice, *tenai*, *samai* and *varagu* (*Paspalum scrobiculatum*, L.) are also mixed with *Konda jonna*. Sorghum is grown as a pure crop also, but in very limited areas.

In the Kistna and Guntur districts the area of sorghum is about 635,000 acres. In this region it is grown mostly for fodder in the *punasa* season and for grain in the *pyru* season. The common variety is *Patcha jonna* (yellow grain), of different types of varying duration. *Konda jonna* (*Talaivirichan cholam* type) is rare. Sorghum figures in the same land only once in 3 or 4 years. The other crops grown in rotation with it are tobacco, chillies, cotton, groundnut and *cumbu*. Two crops are usually grown in the same year, both being short in duration. Sorghum or *cumbu* mixed with pulses and oilseeds are the chief crops in the *punasa* season and tobacco, chillies, variga (*Panicum miliaceum*, L.), *pyru jonna* (sorghum), coriander (*Coriandrum sativum*, L.) and horse gram in the *pyru* season. Cotton and red gram are sown in the *punasa* season mixed with short duration cereals (*cumbu* or *tenai*) which are harvested in about three months leaving the cotton or red gram in the field for the *pyru* season crop. Various crops are grown mixed with sorghum. Some of them are *pillipesara* (*Phaseolus trilobus*, Ait.), *tegapesara* and *kollanganjeru* (*Ipomea hispida*, R. & S.) to improve fodder, red gram, green gram, cowpea, sunhemp, gogu, gingelly, and also a variety of cucumber–*Nakadosakaya* (*Cucumis Melo* L. var. *utilissima*). Only some of these and they too only in small quantities (about $\frac{1}{8}$ or $\frac{1}{16}$) of each are mixed with sorghum, which doubtless occupies more than three fourths of the land. Sorghum is sometimes grown as a mixture with *tenai* or *cumbu* in the *punasa* season and with *variga* in the *pyru* season in parts of the Guntur district. In these mixtures sorghum occupies a fourth or less of the area. Sorghum is sometimes grown in field borders for fodder purposes. In some black soil areas in the Guntur district sorghum is often grown as a pure crop.

In the four districts of Kurnool, Cuddapah, Bellary and Anantapur (the ceded districts, as they are commonly called), about 1,779,000 acres of sorghum are grown annually. In this region sorghum is the crop of major importance. It is the chief food and fodder crop of the area. It is usually grown in rotation with cotton—pure or mixed with *tenai*, or groundnut, the choice of the rotation crop depending upon rainfall and market conditions. Thus sorghum is grown in the same land in alternate years in most of the area, and in some places once in three years. In parts of the Bellary district where *Mungari jonna* (early season sorghum) is grown, no regular rotation is practised.

In the Kurnool and Cuddapah districts the common variety is *Patcha jonna* (yellow grain) and in the Bellary and Anantapur districts, it is *Tella jonna* (white grain). In portions of the Kurnool district sorghum is grown as a pure crop, while in the rest of the district and in the other districts sorghum is grown mixed with various pulses such as red gram, cowpea, green gram, lablab and Bengal gram, oilseeds such as gingelly, safflower (*Carthamus tinctorius*, L.) and castor (*Ricinus communis*, L.), and also sometimes with *tenai*, *cumbu*, indigo and sunnhemp. In all cases sorghum is usually the major crop. Sorghum is occasionally found as a

mixture in *tenai* or *cumbu* in the *punasa* season, or *variga* in the *pyru* season, in parts of the Kurnool district. In these mixtures sorghum forms a very small portion and is used either as fodder or for inducing the production of big earheads for good seed. Sorghum is sometimes grown mixed with cotton also, either of them dominating in area.

In the Nellore district (sorghum, about 428,000 acres) the practices differ from the neighbouring districts. No regular rotation is adopted in the major portion of the district. Groundnut, horsegram or *pillipesara* are sometimes grown in rotation with sorghum. Most of the pulses—green gram, black gram, red gram, *pillipesara* and horse gram are grown mixed with sorghum. In the *pyru* season sorghum and *variga* are grown mixed, wherein the latter is the main crop and sorghum is a minor mixture, about one-eighth.

In the three central districts of Chittoor, North Arcot and South Arcot, the area under sorghum is only about 190,000 acres. Most of the sorghum grown is for fodder only, expecially in South Arcot and in portions of Chittoor and North Arcot. There is no regular rotation. The area of sorghum depends upon the rainfall and the demand for fodder. It is rarely grown mixed. When mixed, the other crop groundnut, red gram, *cumbu* or *ragi* is the major one, sorghum being a minor mixture in it.

In the Salem and Trichinopoly districts, area about 470,000 acres, sorghum is a minor crop, occupying less than one-sixth of the net area cropped annually. No regular rotation is followed. The major crop of the area is either *cumbu* or *ragi*. Often sorghum is a mixture in these crops, occupying only a minor place. The other important crops grown in rotation with these cereals in some parts of these districts are groundnut and cotton. When sorghum is grown as a major crop, pulses such as lablab, cowpea, red gram, green gram and dew gram (*Phaseolus aconitifolius*, Jacq.) and castor or gingelly are grown mixed with it. *Irungu cholam* is grown for fodder and *Sen cholam* (red grain) or *Vellai cholam* (white grain) for grain.

In the Coimbatore district sorghum is the major cereal crop in rain-fed lands. It is grown in area of about 467,000 acres. In parts of the district where only one crop could be grown annually, cotton and sorghum usually alternate. In the South-eastern parts of the district, where sometimes favourable rains are received in the summer season, a short duration sorghum is followed by a short duration pulse, such as Bengal gram or horse gram, in the same year. In these parts groundnut is an important crop in dry lands in the early season (April to August); and this is followed by sorghum mostly for fodder, in the second season (September to January). Thus sorghum is grown in two seasons in this area. The crops grown mixed with it are one or more of the pulses—red gram, green gram, cowpea, lablab and dew gram, and in parts of the district castor and gingelly also. These mixtures occupy only a minor area. The long duration crops

in the mixture—red gram, lablab and castor continue in the field after the harvest of the rest. When lablab is one of the mixtures, odd stalks of sorghum with lablab twining on them are left when sorghum is cut, as lablab matures later. What is thus lost in straw is more than gained by the produce of the pulse twining on it.

In the Madura, Ramnad and Tinnevelly districts, sorghum is grown mainly for fodder purposes, the area under the crop being about 402,000 acres. The variety grown for fodder under rain-fed conditions is *Irungu cholam*. In this variety the grains are small and almost completely enclosed within the glumes It is grown in rotation with cotton and *cumbu*, and in some places with groundnut or *varagu*. Some of the following pulses—red gram, green gram, lablab, cowpea and dew gram, and groundnut, castor or gingelly are grown as mixtures with sorghum.

From the above it will be seen that sorghum is not often grown as a pure crop; it is usually mixed with a wide variety of crops. Most of the pulses and sometimes oil seeds and fibre crops are grown mixed with it. It is sometimes grown mixed with other cereals and rarely with indigo.

Objects and advantages of mixtures. Many are the objects and advantages reported for mixing the various crops with sorghum. These are summarised below. The average holding of a ryot is small. He is not in a position to grow different crops separately. To overcome this difficulty he resorts to mixed cropping. By growing a mixed crop of cereals, pulses and oil seeds, the most common mixture, he is able to obtain most of his food products from the limited land he owns. There is a saving not only in land but in labour also, as in most cases the seeds of different crops are mixed together and sown. By this, sowing and cultivation expenses are minimised. In some places a long and a short duration crop are mixed, such as sorghum and *tenai*, or red gram and sorghum, to get the maximum outturn from the land The short duration crop is harvested first, and the other continues in the field and yields almost as much as a normal pure crop in favourable seasons. When the season is unfavourable, the short duration crop at least yields some produce, thus preventing total loss of outturn from the land due to vicissitudes of weather Also when crops of different durations are mixed the limited labour of the poor cultivator is utilised to the best advantage as different crops come to harvest at different times.

Pulses of three kinds are usually mixed with sorghum. Pulses such as Bengal gram and red gram are mixed for grain. Those, such as cowpea and lablab are mixed with the object of obtaining grain as well as improving the quality of fodder, while others like dew gram, *pillipesara* and *tegapesara* are mixed mainly for improving the quality of fodder. A mixed crop of pulses and cereals is believed to be a good combination to maintain soil fertility, especially when the same crops have to be grown year after year without any proper rotation for want of sufficient land. By this system it is considered possible to maintain the supply of combined Nitrogen in a

way that would not be possible on small holdings if crops are not mixed. It has been reported that cereals grown in association with pulses get enriched in protein content. This is a fruitful line of investigation, especially under Indian conditions, where the toning up of quality of food crops has to be achieved without much extra labour or cost. It is also reported that the mixtures of pulses which are generally small in proportion do not normally reduce the yield of sorghum. Usually about as much yield as from a pure crop of sorghum is obtained from a mixed crop also in favourable years, the produce from the pulse crop thus forming an extra income. It is not economic to grow some of the crops like green gram and cucumber as pure crops; they are therefore always grown as mixtures. Damages due to insects are reported to be minimised by mixed cropping. Sunnhemp when grown mixed with sorghum is reported to be less damaged by insects than when grown as a pure crop.

In some places sorghum is a minor mixture in other cereals such as *tenai*, *cumbu* or *variga*. It is reported that stray plants of sorghum in the field act as a check on cattle being allowed to trespass and graze on the young crop, as sorghum plants in the young stage are poisonous to cattle. Such plants are usually cut for fodder before they mature. Small mixtures of sorghum in long duration crops such as *varagu* or cotton are utilised to obtain good seed, as plants in such crops will be vigorous and produce big, well-filled earheads with bold grains.

Results of experiments. By mixing two crops which feed at different depths in the soil both can thrive well without interfering with each other. Root studies at the Dry Farming Research Station, Bellary, have shown 'Setaria-groundnut' and 'Setaria-horsegram' mixtures are ecologically sound combinations. Spreading pulses such as *pillepesara*, *tegapesara*, dew gram and groundnut reduce soil erosion. Experiments on soil erosion studies at the Dry Farming Station, Bellary have shown that *pillipesara*, groundnut (spreading type), horsegram and mixture of groundnut and horsegram with *tenai* are comparatively more efficient in preventing soil erosion.

In the trials of 'sorghum-pulse' mixtures conducted at the Cotton Breeding Station, Coimbatore, the following conclusions have been recorded:—"On all the three soils (irrigated red, rain-fed red and rain-fed black) the mixing of pulse both with irrigated and rain-fed types of *cholam* does not benefit either the *cholam* or the succeeding cotton. Such a step is found on the other hand to lower the straw weights. It is interesting to note, however, that the after effects of growing leguminous crops on cotton are not alike. Cluster beans have been found most beneficial in the case of irrigated *cholam*, while lablab and cowpea seem to do good to rain-fed *cholam*. Soy beans, green gram and cowpea do more harm than good when they precede cambodia cotton in summer. *Pillipesara* likewise depresses the yield of *Karunganni* cotton that follows it. The above observations bring into doubt the present practice of mixing cowpea with irrigated fodder *cholam* raised in summer. Cluster beans would appear to have

more points in its favour than cowpea. The most suitable proportion for mixing a pulse with *cholam*, when one is needed, is three of *cholam* and one of pulse in the case of irrigated red soils, and one of *cholam* to three of pulse or both in equal proportions in the case of rain-fed soils." The above results are with regard to Coimbatore soils.

Rotation experiments at the Agricultural Research Station, Nandyal (Kurnool Dt.), have shown that a three year rotation: Sorghum—cotton—pulse (groundnut or Bengal gram), is more profitable than a two year rotation of sorghum—cotton (without a pulse) both with regard to yield of sorghum as well as nett produce for three years. Similar experiments at a few other stations have not led to any conclusive results.

Conclusion. It is obvious that more work is to be done in different parts of the presidency to decide the suitable mixtures and rotations for different soils and different seasons. This important question of mixtures and rotation requires a thorough *agro-economic* examination. The question of cereal—pulse mixture in dry lands thus presents a comprehensive set of problems in farming practices, economics, soil physics and nutrition, and demands more systematic attention than it has commanded so far. It is hoped that before long this subject will receive the attention it deserves.

Stone Dragging Competition for Cattle in Kurnool District.

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Introduction. The Ceded District ryot is noted for his skill in the use of his cattle for a variety of agricultural operations. The soils of the tract are generally poor, the rainfall low and ill-distributed and the holdings extensive. The climate is also adverse and the ryot is naturally averse to much of human labour. While ploughing, carting, and mhoting where there are deep wells, are all the operations that cattle are set to do in other districts, the work cattle of the Ceded Districts are put to a much wider use. The work cattle draw heavy ploughs in teams of four to six pairs, while the ryots of the Tamil or Circars country think that such work can only be done by elephants. In this tract crushing big clods raised by the use of these ploughs is done by cattle power while in other districts to break much smaller clods raised by the wooden ploughs, manual labour is engaged. Where the stubbles of cotton and sorghum are dug out by manual labour elsewhere, the Ceded District ryot removes them over wide areas by a pleasure drive standing over a blade harrow worked by his cattle.

He drill-sows his seeds economically using lower seed rates and obtains a meticulous uniformity in stand and an admirable straightness of rows which are sometimes several furlongs long. This is achieved with the

aid of his cattle. He weeds his fields and cultivates the soil between rows of crops with the help of cattle. It is an interesting sight to see crops like chillies and tobacco being carefully intercultivated by cattle power, without even a leaf being broken by the careless trampling of the cattle. Though groundnut is a crop of recent introduction in the Ceded Districts the ryot has learnt to harvest the entire crop by the use of his work cattle at less than a fourth of the labour cost expended by the ryots of the Central Districts who still find some excuse or other for the lifting of their groundnuts by human labour. Threshing of produce like Italian millet and sorghum is all done by rollers drawn by cattle. Even in the matter of carting it is a sight to see clumsy looking carts loaded several feet wide and high with miniature hay stacks, causing no little inconvenience to motorists, as these straw laiden carts practically occupy the full breadth of the road. His cattle thus do almost all agricultural operations and it is possible to manage 20 to 50 acres of land with a pair of cattle while the ryots of other districts cannot manage more than six acres with a pair.

Ongole breed of work cattle. The work cattle used in the Ceded Districts are mostly of the Ongole type. These are huge animals generally bred in the Ongole tract, but reared from a young age in the Ceded Districts. Soon after weaning, young male stock are brought by dealers in hundreds to the Ceded Districts and sold to ryots on the instalment payment system. They are carefully reared in their new homes, where they are given names to which they respond on calling, and become so tame that they do not generally require nose ropes. The Ceded District ryot takes a great pride in the proper maintenance of his work cattle and even the most aristocratic of the cultivators tether their cattle at nights in a shed which is usually the enclosed front portion of their residences.

Stone dragging competition. Some of the best Ongole cattle which are noted for their size, steadiness and docility are found in the black cotton soil tracts of Kurnool District. In this area there exists an ancient pastime at which the strength of the work cattle is tested by means of a stone dragging competition. The competing pairs have to drag a huge stone over a firm earthen road. The pair that comes out best has a reputation for strength and is known as the *Rallu gunju eddulu* (the pair that pulled the stone). Such competitions are generally held in many villages during the local temple festivals which attract crowds Ryots usually spend several months in training animals for these competitions. Such training of young animals is comparable to breaking the animals to the yoke. The biggest stone is kept at the Mahanandi temple where vast crowds are attracted for the Sivarathri festival. The temple trustee gives annually a gold sovereign as a prize for the bulls that come first in the competition. There is a similar competition at Ahobilam where the stone is less than 2/3 of the size of the Mahanandi stone. The stone at Mahanandi is $11'-3''$ long $2'-3'' \times 1'-10''$ in section and is calculated to weigh about $4\frac{1}{4}$ tons There is usually a hole provided on the top at one end for attaching a

chain and it is to be drawn over a firm earthern road for a period of 30 minutes. The pair that pulls the longest distance is declared winner. No regular records have been maintained, but it is reported that a distance of 90 feet is the record within recent memory. Animals for competition come from far and wide after getting selected at local preliminary heats. Ryots used to get some very magnificent animals for the competition. Though the honour of winning at these competitions is its own reward, animals that won at the competitions are reported to have been sold for Rs. 1500 to Rs. 1600 a pair—a premium of about Rs. 300 to 400. The Ceded Districts have no good roads to boast of except the trunk and District Board roads and one accustomed to travel into the interior during the rainy season can easily imagine why the ryots have been so particular to test the dragging power of their cattle. It is only these cattle that can take the villager or a stray visitor out of the village to the nearest metalled road after a rain. Two such District competitions in addition to the usual cattle shows were held, one at Mahanandi and the other at Ahobilam in March 1940. The Agricultural and Veterinary Officers and some ryots acted as judges. Cruelty of any sort like beating, goading etc. was prevented. The Sub-Collector of Nandyal presided over both the functions and medals were awarded to the winners. The entries for the cattle show and the stone dragging competitions are declining. It is a great pity that a useful function like this should show signs of decline. It is necessary to investigate the cause and organise the competitions in such a manner as to attract enough entries.

Causes for decline of cattle. One reason for the decline in the competitions is that the splitting of holdings which is silently going on has reduced the demands on big animals with the result that smaller sized cattle are getting to be more in demand.

Conclusion. It would be interesting and useful if such competitions are organised in important cattle fair centres. It may be mentioned that a pair that can drag a $4\frac{1}{4}$ ton stone on a bare ground, can easily drag a stone road roller. When 4 to 6 such pairs are not uncommon sights in team ploughing in the black cotton soil tracts, road rolling of even the heaviest type is an affair with these cattle and the competitions such as these can be turned to more practical advantage.

Further Studies on *Calocoris angustatus* Leth

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Introduction. The cholam earhead bug, as the *capsid* bug is appropriately termed, has been known as a pest of *Sorghum vulgare* for well over 25 years; it infests the earheads, damages the setting grains and thereby causes loss in yield of the grain. In the Madras Presidency, it is seen in pest form, as a rule, in tracts like, Bellary, Cuddapah, Anantapur, Kurnool, Guntur and Coimbatore. It is known to occur in other provinces as well. Nowhere has it ever been recorded as a serious pest except in Mysore where it was reported to have appeared for the first time as a pest in some 'jowar' growing villages in 1936. Punjab, Burmah, Central Provinces, United Provinces, Hyderabad, etc., do grow sorghum on an extensive scale but this insect has not been recorded as a pest so far.

Due to the periodic appearance of the pest and extensive damage caused to the irrigated sorghums raised in March-April, investigation was first started in 1914. Ballard (1916) published the results of preliminary investigations in the form of a bulletin. Subsequently, more detailed investigations were carried out from 1934–37 at Guntur and Coimbatore, the results of which are embodied in this paper.

Incidence of the pest in general. As previously stated, the insect appears in a pest form on sorghum earheads. At Coimbatore, there are two seasons in which the sorghum crops are raised – the irrigated *chitrai cholam* (April to June) and the rainfed *Periamanjal cholam* (August to January). It is established by counts that the severity of infestation is marked in the *chitrai cholam* and considerably less so in the rainfed *Periamanjal*.

The bugs first appear as soon as the earheads emerge out from the leaf sheath; there afterwards, within a short space of time, i. e., a week or a fortnight, the nymphal population mounts up considerably. In the worst years as in 1926 an earhead is likely to carry as many as 350 nymphs. After the grains are well set the population drops considerably. It is interesting to record that prior to the appearance of earheads, adult bugs are known to live inside the spindles of the rainfed sorghums from September but they are not known to breed till and after the earheads appear, i. e., in the middle of October.

Similarly, at Guntur, there are two seasons, the '*Punasa*' the early (June to September) and the '*Pyru*' the late (October-February); white (*Tella*) and red (*Yerra jonna*) are raised in the *Punasa* and the yellow (*Paccha*) in the '*Pyru*'. An intermediate crop of *Pedda jonna* is sometimes

taken from between August and November for fodder. Thus, with the exception of a few months, there is sorghum grown all through the year which makes it possible for the pest to thrive through and to assume pest proportions in a varying degree, year after year. The incidence of the pest follows much the same lines indicated under the Coimbatore conditions. There is an accelerated breeding resulting in a very high population of nymphs about the second week after the emergence of earheads and then a big drop a week after. In the case of *Punasa* sorghums, it has been observed that the middle of September or thereabouts is the period of maximum incidence and heaviest infestation. In Coimbatore, the proportion of adults to nymphs ranges somewhere between 1 : 10 at the time of peak infestation.

Incidence in relation to the shape of earheads and the type of seed. In Coimbatore, as well as Guntur, the close or compact type of earheads representing the *chitrai* and *Tella* and *Yerra* sorghums respectively show a higher infestation than the loose or less compact types. This must be due to the habits of the pest feeding on the swelling grains and developing in concealed situations which the compact types offer in a pre-eminent degree. At Coimbatore, certain types, *chitrai* sorghum (compact-A. S. 1095) and *chinnamanjal* (less compact) sown about the same period (May 1936) showed striking differences in the incidence of the bug. Whereas A. S. 1095 gave 128 adults and 872 nymphs, *chinnamanjal* gave 168 adults and 152 nymphs for 200 plants.

General incidence of the pest in Coimbatore from May 1936 to May 1937. The incidence of the pest for the three seasons is given for Coimbatore. Population counts taken once a week from 100 plants selected at random were as follows :—

1936 May (A. S. 1095)—92 adults and 950 nymphs.
1936 November-December (Periamanjal)—24 adults and 172 nymphs.
1937 May (A. S. 1095)—136 adults and 408 nymphs.

In all these three seasons the yield was average and hence the incidence must be held to be mild and light.

Nature and extent of damage. Both the adults and nymphs are sap-feeders. The severity of attack varies with the stage of growth of the earhead at which it is attacked. If the earhead is attacked just before it emerges from the sheath by a large number of nymphs there will be no grain formation. The whole head then takes a red and unhealthy appearance and is swathed in a gummy or resinous exudation. If the infestation starts after the head emerges out, damage is somewhat less severe. There is not much of damage if the pest attacks after the flowers are well set and the grains have begun to harden. A few laboratory trials with potted plants indicated likewise.

Alternate host plants. Fletcher (1917) has recorded *Calocoris* as a pest of *cumbu* (*Pennisetm typhoideum*) but not mentioned the locality. The

authors have not found it as a pest on *cumbu* at a time when there was sorghum in the field. It was stated to breed on the male inflorescence of maize but the fact has yet to be confirmed. Apparently, the adult bug keeps on feeding on the green grasses and starts breeding in sorgum earheads alone.

General life history studies. Ballard's studies (1916) have shown that the bug takes 15—17 days to complete its life cycle. Mr. Krishnamurti's studies at Guntur (1935) show that the life cycle is shorter by 2 to 3 days. Attempts by the second author to follow up the life history at Coimbatore have met with little success so far. Though identical conditions were given, the bugs refused to breed and lay eggs even though each female had 12 to 16 eggs inside its abdomen. It would appear that the weather had got something to do in inhibiting or accelerating the tendency for egglaying. The pest ordinarily gets through only one generation on the earhead; by the time a second generation is reached the grains become well matured and stony hard so that they are unfit for them to feed on; in such cases, the nymphs appear to be content to feed on the main stalk.

Control Experiments. The treatments consisted in the use of 'Cooper's special spreading sulphur' as a dust. The first part of the experiment was to ascertain if one dusting alone is sufficient or two dustings were essential; the second part of the experiment was to find out at what stage of the growth of the earhead dusting should be given to secure good results. Dusting was done in the morning with a bellows hand duster; the earheads and the flag leaf got a good coverage of the dust. In no case was there any interference with the setting and formation of grains as a result of the above dusting.

In 1936 population counts were taken once a week for four weeks both from the control and treated plots from 200 plants selected at random; the first count was taken just a week after the earheads had emerged out. Table I gives the population counts.

TABLE I. Population counts of *Calocoris angustatus*.

Date of emergence of earhead—3-5-1936.
No. of plants under observation—200.

Treatments.	Dates on which counts were taken.	No. of insects counted.		Remarks.
		Adults.	Nymphs.	
1. Bulk (before treatment)	11—5—36	14	137	The fourth count was not taken into consideration owing to interference by Ragmus (capsid bug).
2. Sulphur dusting	15—5—36	116	730	
	25—5—36	154	706	
3. Control	15—5—36	168	1512	
	25—5—36	114	1900	

It will be seen from the table that the infestation has reached the peak in about a fortnight to three weeks after the emergence of the earheads and

Exports.

	To Burma. Eggs. (lakhs)	Value (lakhs of rupees)		To Ceylon. Eggs (lakhs)	Value (lakhs of rupees)	
1930—31. All India	374	8·9		115	3·5	
1936—37. All India	236	3·7		2·2	0·04	
			Price per 1000 eggs.			Price per 1000 eggs.
1930—31. Madras Presidency.	91	2·4	26 3	115	3·5	30.4
1936—37. Madras Presidency.	5	0·1	20·0	2·2	0·04	20·6

The entire trade to Burma is of preserved eggs. Of the total exports from India, the share of Bengal is over 80 per cent. The export to Ceylon is entirely from Madras. If the present rate of decline continues Madras might stand to lose the entire trade with Burma. The reason appears to be that Madras exports mostly hen eggs which are expensive compared with the duck eggs supplied from Bengal

In the case of Ceylon the decline is due to the fact that from 28th July 1934, the import duty of 12½% on the tariff value was raised to a prohibitive duty of Rs. 3/- per 100 eggs i. e., equal to the value of eggs.

In 1930, one Bombay merchant at the instance of the United Poultry Association, Lucknow, sent a consignment to London. The details are :—

Expenditure.	Rs.	a.	p.
14,400 hen eggs at Rs. 3—10—0 per 100. ...	522	0	0
Packing (10 cases)	40	4	0
Transport etc.	16	15	0
Freight.	103	10	0
	682	13	0

Receipts.				
14,400 eggs at 5sh. 3 d, per 120 eggs. ...	£ 31	10	0	
Less commission (5%)	,, 1	11	6	
	29	18	6	or Rs. 403
Loss Rs.	279	13	0	

On an average the producers in India, get Re. 0—2—11 per dozen of mixed hen eggs or in other words the producers get about 58·7 per cent of the price paid by the consumers, In the case of duck eggs the producer gets about two-thirds of the retail price.

Grading. The Agmark classification is as shown below :—

Special	1⅞ oz and over.
"A"	1¾ oz. to 1⅞ oz.
"B"	1½ oz. to 1¾ oz.
"C"	1¼ oz. to 1½ oz.

Grading Experiment. It was observed that if the eggs were sold ungraded they fetched a flat price of Rs. 2—0—1 per hundred, upon grading them and selling them on quality basis the realisations have been as shown under : –

		No. of eggs obtained of different grades from hundred ungraded eggs.	Rate of sale per hundred. Rs.	A.	P.	Amount realised. Rs.	A.	P.
Marked								
Agmark	A.	25·6	2	9	0	0	10	6
,,	B.	49 5	2	7	8	1	3	8
,,	C.	21·5	2	4	11	0	7	11
Unmarked.								
Small		1·1	1	11	10	0	0	4
Cracked etc.		0 6						
Stale		1·7	1	0	0	0	0	4
		100·0				2	6	9

It may therefore be seen that the aggregate return from the sale of hundred eggs after grading them is Rs. 2—6—9 against Rs. 2—0—1 only from the sale of ungraded eggs. This amounts to a gross increase of about 20 percent over the price of ungraded village eggs and indicates the prospects that lie in grading. Because of their uniformity, pleasant appearance and freshness it pays to grade eggs, but the difference in size does not attract a commensurately higher price. This gives rise to the important issue of introducing a method of selling the eggs on the basis of weight, provided the interior quality is reliable. In the absence of a weight basis it is difficult to see how buyers are made to appreciate the fact that it is actually cheaper to buy the larger eggs.

		Minimum calculated weight per 100 eggs.	Calculated price per lb. of eggs. Rs. A. Ps.
Agmark	A.	10 lb. 15 oz.	0—3—9
,,	B.	9 ,, 6 ,,	0—4—3
,,	C.	7 ,, 13 ,,	0—4—9
Small.		6 ,, 4 ,,	0—4—5½

Transport. For packing and transport of eggs sent in lime pickle to Burma from Bengal and Madras large heavy earthen jars are used. A jar generally contains about 3500 hen eggs or 2500 duck eggs.

It is observed that the urban demand is high during the cool, dry months and at its highest in November—December. Production is at its peak in March—April.

Industrial uses. For industrial and other purpose e. g. glazing, book binding, preparation of medicines and tanning, a very small number of eggs is used. So far, however, in India none have been used for the preparation of industrial egg products such as frozen, liquid or dried yolks or whites (albumen). China at present is the source of about 95 percent of the total world exports of egg products, but enquiries indicate that this would be a fruitful line of action for local enterprise in India, particularly in Bengal and in the Cochin and Travancore areas. There appears to be a market for sale of hard boiled eggs on the railway platforms, etc. This is being done in some parts of N. India.

General method of grading. There are four stages viz., (a) sorting of cracked eggs and cleaning of other eggs, (b) candling, (c) grading, (d) marking or stamping the graded eggs.

Hatching. An ingenious method of artificial hatching in warm rice husk practised by the Chinese in Burma, as described, is well worth reading.—M. K. R.

Rice Breeding in Burma J. W. Grant, *Indian Farming* (1940) 606—608.

Rice is by far the most important crop in Burma and covers an area of about 12¾ million acres. It is grown year after year in these lands with no rotation what-so-ever. The annual exportable surplus of rice (not in husk) from Burma is over 3 million tons. On account of the large number of markets for Burma rice, many different qualities of grain are in demand. Shortly after the first great war, Burma began to lose some of her Western markets on account of the competition there from high-grade rices produced in America, Spain and Italy, and in 1931 a grant was made by the Imperial Council of Agricultural Research for Rice Research in Burma, half of the funds being provided by the Empire Marketing Board. A short account of the breeding work carried out during the period of the grant i. e., 1931—1937, is presented in this article. Since pure line selection is carried out on all Agricultural Stations, intensive work on hybridisation was taken up under the Rice Research scheme with the special purpose of synthesising high yielding strains with good quality grain so as to suit the

demand in the different markets. Sixty-six exotic varieties obtained from subtropical regions were submitted to yield tests, but all of them matured too early and proved to be very poor yielders. None of the imported tropical varieties could also out-yield the local strains. During the period of the grant a large number of crosses were made and studied with definite objects in view besides taking over 201 hybrid cultures in various generations from Hmwabi Agricultural Station. At the end of the period of the grant, two hybrid strains of a local Ngasein cross, which had come out successful in yield tests were under cultivation in about 10,000 acres in Lower Burma in 1938. The grain in both cases approach American Blue Rose variety in size and quality. The occurrence of sterility and partial sterility in crosses between local and exotic varieties proved to be a serious handicap but these were eliminated in 7 or 8 generations by rigorous selection of fertile plants. At the end of the period of the grant there were 450 hybrid cultures in various generations under study and 55 cultures were under yield test on the Rice Research Station and at various centres in the districts. Many of the hybrid cultures with good quality grain were also promising as regards yield. The quality of rice as demanded by the different markets was always kept in view in the course of the breeding scheme. Hard translucent rice is exclusively in demand in high-grade markets of Europe whereas high out-turns of whole rice in milling are desirable for all markets. The promising strains were submitted to milling tests both inside the laboratory and in a small commercial rice mill before being distributed to the cultivators. The advice of the various Chambers of Commerce in Rangoon was also regularly sought regarding the qualities of rice. The work carried out during the period of the grant from the Imperial Council of Agricultural Research indicated that considerable improvement can be effected in the Burma rice crop by breeding and selection, particularly as regards commercial quality. Most of the cultures under study at the end of the period of the grant were of much better quality than those obtained by pure line selection within local varieties, and from yield tests that were in progress at that time there was every indication that quality could be combined with satisfactory yielding capacity. -- K. R.

The effect of differential irrigation and spacing on the field behaviour and quality of Cambodia CO_2 cotton, Ramanatha Ayyar, V. Nazir Ahmad and N. C. Tirumalachari, *Ind. Jour. Agri. Sci.* 10 (1940) : 493.

Nearly 60 per cent of the area under Cambodia cotton in Madras Province is being irrigated from water lifted from wells and irrigation forms an expensive item in the cost of production. It was therefore thought desirable to find out if the present practice of cotton growers to irrigate their crop very frequently was not wasteful. With this purpose, experiments were conducted during 1932--1935 on the Cotton Breeding Station in Coimbatore, to determine the optimum frequency of irrigation for a crop of Cambodia cotton and to study whether such frequencies would affect the qualities of fibres. In the trials conducted during the first two years, the soils were reddish loam and the soil used in the third year was distinctly alkaline and heavy, with defective drainage. The irrigational treatments were confined to the non-rainy period from the middle of December to the middle of April during which the crop suffers from insufficiency of soil moisture. Twelve treatments in all were introduced, combining four variations in irrigation, viz., (1) No irrigation, (2) irrigation once a week, (3) irrigation once in two weeks, (4) irrigation once in three weeks and three variations in spacing viz., 4″ and 9″ between plants in ridges, and broadcast in beds. The treatments were laid out in randomised blocks replicated four times during the first two years and three times in the third year. The quantities of water consumed in each irrigation in all the treatments were measured with the help of Kents Lea recorder. Fibre tests included the determination

of the mean fibre length, mean fibre weight per inch and percentages of mature, half mature, and immature hairs. The spinning performance and yarn neppiness were also found out. The conclusions are summarised thus:— (1) Irrigating Cambodia after December improved the yield definitely, (2) Irrigating once a week tended to give the highest yields but not remunerative returns, (3) Irrigating once in three weeks was most profitable, (4) The quantity of water consumed at each irrigation by 'one week' plots was distinctly less than in plots irrigated once in three weeks, (5) There was little difference in the consumption of water between ridge and bed system of irrigation, (6) variations in the density of plant population had no effect on water consumption, (7) The frequency of irrigation and the different modes of sowing had no appreciable effect on the mean fibre length of this cotton, in the experiments of the first two years. In 1934—35, season, however, the 4 in. spacing gave, on the whole, somewhat higher mean length than 9 in. spacing, which, in its turn, gave slightly better results than broadcast sowing. (8) Hair weight per inch of cotton showed a tendency to increase with the amount of irrigation given to the crop. Mode of sowing had no effect on hair weight in the first two seasons, but in 1934—1935, samples from '4 in.' plots proved finer than from '9 in.' plots and 'broadcast' plots. (9) Irrigated samples contained a higher percentage of mature fibres than the unirrigated samples. The mode of sowing did not affect the maturity count in 1932—33 and 1933—34 seasons, but in 1934—1935, samples grown with 4 in. spacing contained a lower percentage of mature hairs. (10) The total loss sustained by this cotton in the blow room and the card room was independent of the mode of sowing, but, it was somewhat less when the cotton was grown under irrigation. (11) While the yarn neppiness of this cotton is independent of the mode of sowing adopted in this experiment, it is appreciably reduced by growing it under irrigation. (12) The mode of sowing did not affect the spinning performance. The yarns spun from irrigated samples gave lower strength as compared with those spun from the unirrigated samples. S. K.

Gleanings.

Economic Survey of Madras Villages. The Economics Department of the University of Madras is to be congratulated in conducting economic resurvey of the villages originally surveyed under the guidance of Dr. Gilbert Slater. The main conclusions which can be drawn from the results presented by Dr. Thomas are:—

(1) the growing rural congestion in certain areas and increasing sub division and fragmentation of holdings (2) the growing number of non-cultivating landholders and the increase of tenancy, (3) the large increase of landless labourers and the decay of customary relations between landowners and labourers, (4) slow progress of agricultural improvements, (5) growth of indebtedness, although the rates of interest had fallen much, (6) the growing disparity in the incidence of Land Revenue between different classes of land, calling for a readjustment of the Land Revenue system, (7) extensive progress in communications and breakdown of village self-sufficiency, (8) changes in diet—from millets to rice, from hand-pounded rice to milled rice—and the growing popularity of coffee and tea. Rural incomes range from Rs. 73 to 40 per head. Food supply seems to have kept pace with the growth of population, but while the quantity of carbo-hydrates available is more than adequate; there is an insufficiency of fats and proteins. During the period under survey, industrial areas have made more rapid progress than agricultural, largely owing to the protective tariff policy followed by Government. While the economic activities of Government in the past have greatly benefited the urban classes, the beneficial effect on the population of rural areas

has not been so appreciable, and everything points to the need for a concentrated effort in rural development.

The picture is by no means encouraging and however much those engaged in rural work including the Govenment may protect. there is no denying the fact of woeful neglect of villages. * * * * * [*Mad. Jour. Co-op.* 32 (1941) 390–391.]

Ripening of the Banana. The banana differs from many other fruits in that cut from the tree (after allowing some forty days for early stages of development) it will continue to ripen, none the less the developmental processes at work whilst on the tree probably have a determining influence in respect of the time limits at which fruit may be cut for exportation, considerable practical importance probably is attached, therefore, to such studies as those described by H. R. Barnell of the Low Temp Res. Station, Imperial College of Tropical Agriculture, Trindad (*Ann. Bot.* N. S. 4, 1940). He has followed the changes in dry matters and various types of carbohydrates and acidity in the pulp and skin of the fruit, during development in the plant, from the time the fruits emerged until they rotted. It had been proposed to study the quality of fruit left to ripen on the plant but in these Trindad observations, after the 'hundredth' day, the fruit began to split and then to fall and rot. It would seem that the Gros Michel variety under these conditions is more suited to picking at an incipient ripening stage and export than home consumption as ripe fruit gathered from the plant. The banana is relatively unusual also in the low sugar content in the early stages of development when strach is rapidly accumulating; the splitting later is associated with a rise in water content of the pulp as the sugar content begins to increase. Off the plant, bananas at this period will ripen with sugar formation in the pulp, but there is less danger of splitting as only a relatively small amount of water can migrate into the pulp from the skin. Unlike the apple in its high starch accumulation and low sugar concentration, the banana also differs in that along with starch synthesis there is a continuous fall in the acidity of the pulp—rising acidity values are only met with as starch hydrolysis begins after about the 100th day. [*Nature* 146 (1940) 494.]

Agricultural Jottings.

PREPARATION OF COMPOST BY THE ONGOLE MUNICIPALITY

The actual preparation of municipal rubbish into compost with night-soil was started during August 1939 at the advice of the Agricultural Department by the Municipal Health Officer, Ongole. The following gives the details of work from August 1939 to the middle of 1940.

The composting yard is at first cleared, made even, and di ided into 12 suitable plots with intervening pathways. Each one of the above plots represents, the composting product during a month. In a proportion of each of the above plot, a days street refuse and night-soil of the town is applied in the following way:—

The municipal street refuse after it is sorted out of stone and glass pieces etc., which it generally contains is at first spread, as a stack to a height of 1′—6″ from the ground. This forms the first layer of the heap and upon this night-soil and street refuse in layers of different thickness are again put, so that a complete heap that comprises of one day's street refuse and night-soil of the town, would be four feet six inches in height. A complete heap in this place. consists of the following layers from bottom to the top.

			Ft.	in.
1.	Height or thickness of the 1st layer of street refuse.		1	6
2.	Do	night soil	0	9
3.	Do	2nd layer of street refuse ...	0	9
4.	Do	night-soil	0	6
5.	Do	3rd or top layer of street refuse	1	0
		Total...	4	6

These heaps are raked up once in 10 days and sprinkled with water for four months after they are started. By this time the whole stuff gets mixed up and forms itself into a most inoffensive poudrette.

The proportion of night-soil added to the refuse during the process is approximately 1: 4.

Prior to the starting of this method the Municipality was simply trenching the night-soil and dumping the street refuse in separate places. Practically the night-soil trenches were never sold and the dumped street refuse when bid for auction used to get only a very insignificant amount. For instance the sale proceeds that the Municipality got for 12 months during 1938—39 was only Rs. 51. But compost product which resulted in hardly eight months from August 1939 to the end of March 1940 had fetched the Municipality an income of Rs 903/-.

Apart from the increased revenue that this method of disposal had fetched to the Municipality, it is attended with several other advantages which are absent in other methods of disposal. If only some regular attention is paid, the composting process can be successfully carried on, without any offensive odours emanating from the heaps. Even fly breeding can be said to be entirely nil.

No special staff has been engaged so far for this work in this Municipality. The work now is being adjusted by the regular scavengers only who are whole-time workers in this Municipality and whose business is also to sweep the streets and latrines in the town. Only for the last four months a skilled scavenger has been appointed exclusively to supervise the stacks and to watch the heaps. His monthly salary is only Rs. 9/-. *(From the Director of Agriculture.)*

COTTON SEED FLOUR

The manufacture of this product is described quite fully in *Food Industries*, July 1935, p. 342. This article referred to so called nutty brown flour made by the Nutty Brown Mills of Houston, Texas. Another flour which is used in this country for food purposes is made by the Traders Oil Mill, Fort Worth, Texas. This product is called 'Pro Flo'. According to the Connecticut (New Haven) Agricultural Experiment Station Bulletin 476, nutty brown flour contains 7·4 per cent moisture; 5·5 per cent ash; 4·0 per cent fibre; 12·7 per cent fat; 49·1 per cent protein and 21·3 per cent nitrogen free extract. The latter includes about 6 per cent of starch.

Texas Agricultural Experiment Station Bulletin 128 relates to cotton seed meal as a human food and gives considerable information along this line.

In the *Jour. Ind. Eng. Chem.* Vol. 6, p 338 (1914), C. A. Wells tells of the characteristics of cotton seed flour.

The following U. S. patents should prove of interest: 1,276,447 and 1,142 243.

According to *Food Industries* mentioned above, cotton seed is thoroughly cleaned to remove dirt and then subjected to the linters machine where about 20 pounds of lint are removed per ton of seed. The seed thus partially cleaned is subjected to a second battery of linters where an additional 75 pounds of lint is removed. This cleaned seed is then sent to the hullers, which remove the hulls; the kernels are subsequently purified and the meats are conveyed to pressure rolls where they are converted into flakes about one hundredth of

an inch thick. The rolling operation prepares the meats for cooking and pressing. Cakes are formed under 350 pounds pressure. One ton of cotton seed yields 310 pounds of oil, 506 pounds of hulls, 95 pounds of lint, 8 pounds of miscellaneous or foreign material, 150 pounds of water and 920 pounds of oil cake, from which approximately 600 pounds of flour are obtained.

(*From the Director of Agriculture.*)

SCHOOL CHILDREN FIGHT HAIRY CATERPILLAR PEST

For many years past the Department of Agriculture has been endeavouring to persuade ryots to co-operate in fighting the Hairy Caterpillar Pest and in some districts the Agricultural Pests and Diseases Act has been in force. Both persuasion and compulsion have in most cases not been fully effective.

It was thought that it is not common sense for the children in villages to sit in school when this pest is literally devouring their fathers' crops. With the approval of the Director of Public Instruction, the Presidents of District Boards in areas where the pest was likely to be serious were therefore requested to issue instructions to all elementary schools in the areas affected directing all teachers and children to work as volunteers in the afternoon for a week or two when this pest appears, under the supervision of the local agricultural officers. The work expected of the teachers and children were: (1) persuading ryots to take the necesssary control measures advocated by the department, and (2) picking egg masses on waste lands which no one else is dealing with. The procedure adopted was that the local Assistant Director of Agriculture declared "an agricultural emergency" when the pest threatened to be serious in any area and then applied to the President, District Board, to issue necessary instructions for the purpose referred to above.

Reports received from North Arcot, South Arcot and Tanjore Districts show that the participation by elementary schools in the fight against the pest was both willing and effective. (*From the Director of Agriculture.*)

Moffussil News.

Guntur. An Agricultural Exhibition on a large scale was arranged at the Hindu College, Guntur on the 14th and 15th December last and the credit for its grand success goes to a large extent to Sri. P. Venkateswara Rao, B. Sc. Ag., Lecturer in Agriculture at the college. Sri. R. Swami Rao, Assistant Director, Guntur opened the exhibition which consisted of a model orchard arranged by the late Sri. P. Parthasarathy, B. Sc. Ag., and a large variety and collection of exhibits from the Agricultural Research Station, Guntur.

The monthly social gathering organised last April, at which all the officers, friends and well wishers of the Agricultural and Live-stock Research Stations, Guntur, meet every month at Tea for social-contact and exchange of ideas, continues with great enthusiasm and has been responsible for popularising the activities of the station and directing the attention of those interested in the locality. At the gathering held this month on the 6th instant, several gentlemen including Sri. R. Swami Rao, Assistant Director, Guntur, spoke in touching terms referring to the untimely demise of two of the officers of the station, both of whom were connected with the newly started fruit work at the station. The late Sri. K. Rajabapanya and the late Sri. P. Parthasarathy were trained in fruit work, were unostentatious and extremely capable in their work and their premature death is a severe loss to the Department.

Old students and friends of the late Dewan Bahadur K. Rangachariar who was Government Lecturing and Systematic Botanist at Coimbatore will be glad to learn that one of his sons Sri. K. Seshadri, now working at the Agricultural Research Station, Guntur, has been selected by the Civil Aviation Department New Delhi, for training in the Indian Air Force in accordance with the newly started scheme for training of pilots and mechanics for the air force. He has been posted for training at Calcutta.

P. M. Kharegat Esq., I. C. S., C. I. E., Vice Chairman, Imperial Council of Agricultural Research accompanied by Rao Bahadur B. Viswanath. Director of the Imperial Agricultural Research Institute, New Delhi, visited the Station on the 6th February 1941. The distinguished visitors showed keen interest in the work of the station and a small but imposing show was put up showing the achievements of the station in crop improvement work and on the new line of profitable disposal of virginia tobacco seed. The same afternoon, the Vice-chairman opened the first Market yard at Guntur for the Tobacco Market Committee at Guntur. Sanction has been obtained for making a survey in the chilli (*Capsicum*) growing tracts of the presidency with a view to collect resistant types in connection with the improvement work on chillies now in progress at the Agricultural Research Station, Guntur. Sri. M. P. Narasimha Rao, Cotton Assistant has started the survey work this month in the Circars. S. V. D.

Avadayarkoil. An agricultural exhibition on a small scale was conducted at Avadayarkoil (Arantangi taluk) on the 10th and 11th January 1941 during the *Arudradarisanam* festival. Different departmental paddy strains, sugarcane varieties, fodder grasses, varieties of green manure seeds, and crops raised in pots, improved implements and posters on all crops &c., were exhibited at the stall. Nearly 20,000 visitors who were mostly agriculturists visited the stall and evinced keen interest. A large number of querries put by the interested ryots regarding, bee keeping, cultivation of sugarcane, cotton and green manure crops etc., were answered in detail by the Agricultural Demonstrator, Arantangi. Two lectures were delivered on improved methods of agriculture. During the exhibition 1,000 Napier grass slips and 20 lbs of kolinji seeds were sold and the former planted in two places. The Trustee of the Avadayarkoil Devasthanam, Sri Namasivaya Thambiran and the Superintendent took keen interest in the exhibition. The Tanjore District Board with their Rural Reconstruction van and Radio set and the Public Health Department participated in the exhibition and made it a success. A. G. N.

Chidambaram. An agricultural exhibition was held during the local *Arudra Dharsanam* festival at Chidambaram from the 6th to 12th January 1941. It attracted more than 10,000 visitors from the rural areas of the neighbouring taluks. Paddy and rice samples of the important strains of Aduturai, Palur and Coimbatore Agricultural Research Stations, Groundnut, gingelly and castor selections from Tindivanam station, budded citrus and grafted mango plants from Kodur Fruit Research Station, were exhibited. Sugarcane varieties, fodder grasses and plantain varieties from Palur and Aduturai were on view. Improved implements for tillage and interculture, cream jaggery and malt samples appliances and chemicals used in the control of pests and diseases were also among the exhibits. Illustrated posters in the local languages detailing all the improvements advocated by the Department were a feature. Two lantern lectures and several ordinary lectures were delivered to the interested ryots by the local Agricultural Demonstrator and the plant pathological Demonstrator of the division. M. A.

Correspondence.

To

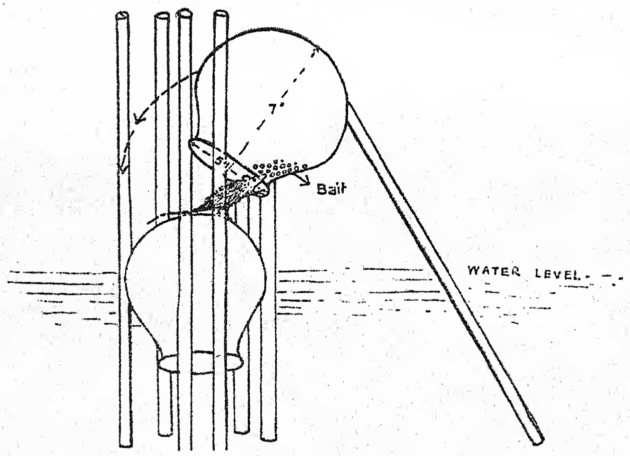
The Editor, Madras Agricultural Journal.

I. A simple rat-trap.

Sir,

Field rats are one of the most common pests of paddy, taking a heavy toll of the crop at times. The rodent damage especially in a rice research station, where valuable comparative yield trials are conducted in strip plots is a great nuisance, vitiating the results of the experiments and so to keep the rat trouble under control, various methods such as, (1) cyanogas fumigation of the rat-holes (2) placing poisonous rat baits like sodium arsenate or barium carbonate mixed with cooked rice, on the field bunds, (3) hand catching by professional rat-catchers, and (4) a local device of trapping rats by two small mud pots, were tried in this station. Among these, the last method has been found to be most efficient and quite successful and it is described below.

This rat-trap is a simple device and consists in setting up two small mud pots (capacity one and a half Madras Measure by volume) by means of seven bamboo stakes (2′ × ½″ × ½″), one pot is placed with its mouth downwards in the soil and it is tightly held in position by six bamboo stakes. This inverted pot is pressed into the puddle soil keeping its top surface 2 to 3 inches above the level of water in the field. Just over and above this pot, another pot of the same size is rested on three bamboo stakes 20 inches long in a tilting position as shown in the diagram. Care should be taken to adjust it in such a way that when it is lightly touched it is tilted and slips down on to the resting pot. Fried paddy grains of good aroma and flavour are placed inside the catch pot and some grains are placed on the top of the bottom pot also. When a rat attempts to eat the bait inside, the top pot which is kept in a tilting position falls suddenly on the resting pot trapping the animal.



A cooly goes round the field every morning and kills the trapped rats. The top pot is gently raised about ½ inch when the tail of the rat is protruded. The rat is pulled by its tail and by manipulating the pressure on the body of the rat, he takes hold of the neck in a firm grip. In the case of small and medium sized animals the pressure exerted on its neck by the rim of the top pot is enough to kill them. With full grown animals the catcher grips them firmly by the neck with one hand and by the other hand gives a quick and forcible pull to the tail. This kills the rat instataneously.

This rat trap is quite simple and cheap costing about one anna only. A dozen such traps set up in an acre from the shot-blade period of the crop may be

adequate to trap the rodents visiting the field. It may be recorded that by this method 75 field rats were effectively trapped and destroyed at this station during the year 1939-40.

Being cheap, simple and efficacious this method may commend itself to any ordinary ryot to keep the rodent trouble under control.

Yours etc.,

Rice Research Station. Ambasamudram, Tinnevelly. M. Subbiah Pillai. S. Krishnamoorthi.

To

The Editor, Madras Agricultural Journal.

II. Croton Sparsiflorus—manurial value.

Sir,

Anent the article on "Two exotic weeds—How best to use them" published in October 1940, I may be permitted to draw the attention of the readers of the *Madras Agricultural Journal*, to the fact that 4,000 lb. of green-matter of the weed. *Croton sparsiflorus* was compared against an equal amount of sunnhemp (*Crotolaria juncea*) with a 'no-manure' control for three seasons (1933—35) at the Rice Research Station, Berhampur. The results on the paddy crop showed that the effect of the application of the weed was as good as that of sunnhemp, and gave an average increased yield of 12 per cent of grain over 'no manure'.

Agricultural Research Station, Maruteru, W. Godavari Dt. Yours etc., M. B. V. Narasinga Rao.

Crop and Trade Reports.

Statistics—Paddy—1940-41—Final forecast report. The average of the areas under paddy in the Madras Province during the five years ending 1938-39 has represented 13·2 per cent. of the total area under paddy in India.

The area sown with paddy in 1940-41 is estimated at 10,467,000 acres as against 9,614,000 acres for the corresponding period of the previous year and the finally recorded area of 9,884,316 acres in 1939-40. The present estimate exceeds the final area of the previous year by 5·9 per cent. and the area of 10,211,440 acres in a normal year by 2·5 per cent.

1,539,000 acres have been reported as sown since the last December forecast was issued. The extent so sown was large in the South (420,000 acres), the Carnatic (405,000 acres), the Central districts (290,000 acres) and the Circars (230,000 acres). The area sown in December and January was greater than that sown in the corresponding period of the previous year by 411,000 acres or by 36·4 per cent.

The area under second crop paddy is expected to be above normal owing to the heavy rains received in November in most districts.

The harvest of the main crop of paddy is in progress.

The crop was affected to some extent by the heavy rains in November 1940 in parts of the districts of South Arcot and Tanjore, by drought in parts of the districts of Vizagapatam, East Godavari and West Godavari, by the attacks of insects in parts of the districts of Chittoor, North Arcot and Coimbatore and by plant diseases in parts of the districts of Guntur, Anantapur Cuddapah and Tanjore. The yield is expected to be above the normal in Salem (110 per cent.), normal in Kurnool, Bellary, Nellore, Madura, Ramnad, Tinnevelly and the Nilgiris and below the normal in the other districts. The seasonal factor for the Province works out to 95 per cent. of the average as against 90 per cent. in the Season and Crop Report of the previous year. On this basis, the yield works out

to 100,540,000 cwt. of cleaned rice. This represents an increase of 11,202,000 cwt. of cleaned rice or 12·5 per cent. when compared with the estimate of 89,338,000 cwt. of cleaned rice in the season and Crop Report of the previous year. The yield in an average year is estimated at 102,450,000 cwt. of cleaned rice.

The wholesale price of paddy, second sort per imperial maund of 82⁶⁄₇ lb (equivalent to 3,200 tolas) as reported from important markets on 10th February 1941 was Rs. 3—9—0 in Rajahmundry, Rs. 3—7—0 in Masulipatam, Rs. 3—6—0 in Guntur, Rs. 3—5—0 in Ellore, Rs. 3—4—0 in Bezwada, Rs. 3—0—0 in Vizianagaram and Tinnevelly, Rs. 2—14—0 in Chittoor, Rs. 2—13—0 in Cocanada and Virudhunagar, Rs. 2—12—0 in Vellore, Rs 2—11—0 in Hindupur and Mangalore, Rs. 2—9—0 in Trichinopoly, Rs. 2—7—0 in Madura, Rs. 2—5—0 in Negapatam, Rs. 2—4—0 in Cuddalore and Kumbakonam, Rs 2—1—0 in Conjeevaram and Rs. 1—14—0 in Anantapur. When compared with the prices published in the last report, i. e., those which prevailed on 6th January 1941, the prices reveal a rise of approximately 14 per cent. in Rajahmundry, 12 per cent. in Masulipatam, 8 per cent. in Guntur, 6 per cent. in Ellore and 4 per cent. in Bezwada and a fall of approximately 32 per cent. in Anantapur, 30 per cent. in Madura, 23 per cent. in Kumbakonam, 18 per cent. in Negapatam, 16 per cent. in Trichinopoly, 10 per cent. in Virudhunagar, 8 per cent. in Cocanada and Cuddalore and 7 per cent. in Hindupur, the prices remaining stationary in Vizianagaram, Conjeevaram, Chittoor, Vellore and Tinnevelly. *(From the Director of Industries and Commerce.)*

Statistics—Crop—Sugarcane—1940—Third or final report. The average of the areas under sugarcane in the Madras Province during the five years ending 1938—39 has represented 2·8 per cent. of the total area under sugarcane in India.

The area planted with sugarcane in 1940 is estimated at 161,850 acres. When compared with the corresponding estimate of 132,010 acres for the previous year and the actual area of 137,633 acres according to the Season and Crop Report, the present estimate reveals an increase of 22·6 per cent and 17·6 per cent respectively. The estimate of the previous year fell short of the actual area by 4·1 per cent.

The present estimate of area exceeds the second forecast by 12·430 acres. The excess occurs mainly in Kistna. South Arcot, and the Central Districts.

The estimated area is the same as that of last year in Tinnevelly. A decrease in area is estimated in Nellore and Coimbatore and an increase in area in the other districts of the Province, especially in South Arcot (plus 8,740 acres), North Arcot (plus 4,200 acres) and Salem (plus 3,760 acres). The area estimated for Vizagpatam, West Godavari, Kistna, Bellary, Anantapur, Cuddapah Chingleput, South Arcot, North Arcot, Salem, Trichinopoly and Tanjore is the highest reported in recent years. The increase in area is due to the favourable price for jaggery which prevailed before the planting season.

The present estimate includes an area of 15.150 acres under ratoon sugarcane in the districts of Vizagapatam (7,000 acres), East Gadavari (2,500 acres), West Godavari (900 acres). Kistna (200 acres), Bellary (1, 400 acres), Chingleput (80 acres), South Arcot (1,200 acres), Chittoor (900 acres), Coimbatore (800 acres), Trichinopoly (100 acres), (Tanjore 50 acres) and Malabar (20 acres).

The crop suffered to some extent from heavy rains in South Arcot, Coimbatore and Trichinopoly. The condition of the crop is generally satisfactory in the other districts.

The harvest has just commenced. Yields above normal are expected in Kurnool, North Arcot and Salem (110 per cent). The yield is expected to be normal in Kistna, Guntur, Anantapur, Nellore, Chingleput, Chittoor, Tanjore, Madura Ramnad and South Kanara and below the normal in the other districts. The seasonal factor for the Province as a whole is estimated at 97 per cent of the

average as against 95 per cent in the previous years according to the Season, and Crop Report. On this basis, the yield is estimated at 4,416.610 tons of cane or 481,510 tons of jaggery (gur) as against 3,753,380 tons of cane or 409,260 tons of jaggery (gur) according to the final figures as revised with reference to the revised figures of normal yield per acre of the previous year. The present estimates reveal an increase of 17·7 per cent over those for the previous year.

The wholesale price of jaggery per imperial maund of 82⅞ lb. (equivalent to 3,200 tolas) as reported from important markets on 27th January 1941 was Rs. 4—3—0 in Erode, Rs. 4—2—0 in Adoni, Rs. 4—1—0 in Cuddalore, Rs. 3—15—0 in Salem, Rs. 3—14—0 in Vizianagaram and Mangalore, Rs. 3—7—0 in Chittoor Rs. 3—5—0 in Rajamundry, Rs. 3—2—0 in Vellore, Rs. 2—15—0 in Cocanada Rs. 2—14—0 in Bellary and Trichinopoly, Rs. 2—8—0 in Vizagapatam and Rs. 2—6—0 in Coimbatore. When compared with the prices published in the last report, i. e., those which prevailed on 9th December 1940, these prices reveal a fall of approximately 29 per cent in Cocanada, 22 per cent in Rajamundry, 18 per cent in Erode, 13 per cent in Mangalore and Chittoor, 12 per cent in Trichinopoly, six per cent in Nellore and three per cent in Cuddalore, the prices, remaining stationary in Vizianagaram, Adoni, Bellary, Salem and Coimbatore.

(*From the Director of Industries & Commerce, Madras*).

Statistics—Crop—Gingelly—1940-41—Intermediate condition report.

Sowings of late gingelly are in progress in most districts and the germination is reported to be satisfactory.

The wholesale price of gingelly per imperial maund of 82⅞ lb. (equivalent to 3,200 tolas) as reported from important markets on 10th February 1941 was Rs. 6-12-0 in Tinnevelly, Rs. 6-10-0 in Tuticorin, Rs. 6-8-0 in Cocanada, Rs. 6-7-0 in Cuddalore and Trichinopoly, Rs. 6-1-0 in Salem, Rs. 6-0-0 in Vizianagaram. Rs. 5-13-0 in Rajahmundry, Rs. 5-11-0 in Ellore and Rs. 5-8-0 in Vizagapatam. When compared with the prices published in the last report, i. e., those which prevailed on 6th January 1941, those prices reveal a rise of approximately ten per cent in Ellore, five per cent in Salem and Tuticorin and one per cent in Trichinopoly and a fall of approximately four per cent in Rajahmundry, the prices remaining stationary in Vizagapatam, Vizianagaram, Cocanada, Cuddalore and Tinnevelly. (*From the Director of Industries, Madras*).

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1940 to 31st January 1941 amounted to 541.922 bales of 400 lb. lint as against an estimate of 366,80 bales of the total crop of 1930-40. The receipts in the corresponding period of the previous year were 496,291 bales. 583,487 bales mainly of pressed cotton were received at spinning mills and 136,428 bales were exported by sea while 161,923 bales were imported by sea mainly from Karachi and Bombay.

(*From the Director of Agriculture, Madras*).

The late Sri. M. Sambanda Mudaliar
(Patron of The Madras Agricultural Students' Union).

OBITUARY

We record with regret the demise of one of our esteemed patrons, Mr. M. Sambanda Mudaliar, B. A., B L., Advocate, Coimbatore. Mr. Sambandam was born in the year 1869, at Madras, of respectable parents. His father, Mr. Muthukrishna Mudaliar was Tahsildar for a number of years in Coimbatore district. Mr. Sambandam was one of the leading advocates in Coimbatore and acted twice as Public Procecutor for short periods. He was a Councillor of the Coimbatore Muncipality for nearly 25 years and was elected Chairman for two terms. This good work and experience in municipal affairs won him a certificate of merit and a silver medal in 1911 and he was honoured by an invitation from the Government of India for attending the Delhi Durbar.

Mr. Sambandam was an elected member of the first Madras Legislative Council under the Minto-Morley Reforms and was also a member of the first Indian Legislative Assembly under the Montagu-Chelmsford Reforms. He was appointed Commissioner for Hindu Religious Endowment Board in 1930 and retired as its acting President in 1935.

He was a patron of Tamil learning and music and a deeply religious man and was a stout champion of popular interests and personal and public liberties. His love for the ryot was no less and he became a patron of the Madras Agricultural Students' Union in 1917.

Mr. Sambandam was very much loved by the people whom he served loyally in several spheres of life for over 50 years.

He passed away in October 1940 mourned by his devoted children, a large circle of friends and the townsmen of Coimbatore. The *Madras Agricultural Journal* joins them in paying the last tributes to the memory of a noble soul and conveys its sympathies to the members of the bereaved family.

College News and Notes.

Students' Corner. *Club activities.* Under the auspices of the Students' Club Sri N. Lakshmanan, founder-secretary of the Tagore Academy, delivered a lecture on 'The creative joy through dancing' on 31st January 1941 at 6 p. m. in the Freeman Hall. Sri R. Srinivasa Ayyangar, B. A., L. T., Headmaster, Saravajana High School, presided. The lecture was accompanied by a dance recital by the lecturer's pupils. A purse of Rs. 22—8—0 was presented to the Academy in appreciation of its invaluable services rendered to the public.

Essay competition. The annual easay-writing competition was held on 10-2-41 in the Freeman Hall. The subject was "Why India should participate in the present war?" and the length of the essay was limited to five pages. Messers B. Seshavatram, N. Srinivasalu and A. Adivi Reddy were the successful candidates in the descending order of merit.

Elocution contest. Sir M. Visweswara Ayya's saying 'Industrialise or Perish' was the subject for the general annual elocution contest held at 6 p. m. in the Freeman Hall on 10—2—41. Speakers were allowed each five minutes to express their opinion. Sri N. Lakshmanan and Mr. K. A. Joseph, Lecturers, Government College and Sri C. S. Chokalingam Pillai acted as the judges. Messers H. Gurubasappa, B. Seshavataram and G. V. Raghavalu were declared first, second and third, respectively.

Inter-tutorial competitions. In the intertutorial elocution contest held on 17—2—41 at 6 p. m. in the Freeman Hall, Sri B. M. Lashmipathi's wards represented by Messers Seshavataram and S. N. Ramasubramaniam were declared winners.

Cricket. Mr. P. V. Ramiah's wards having defeated Sri C. Narasimha Ayyangar's wards and Sri C. R. Srinivasa Ayyangar's wards, met, on 16—2—41 Mr. K. M. Thomas' wards who had previously defeated Sri B. M. Lakshmipathi's wards. Mr. Thomas' wards won by 8 wickets and 4 runs, having scored 70 runs for two wickets, (Shanker Rao 26, Nageswara Rao 15 not out, Somanna 18 not out), Mr. P. V. Ramiah's wards scored 66 all out.

Foot-ball. Sri. M. Kantiraj's wards won creditably after a very keen fight with Sri. B. M. Lakshmipathi's wards.

Hockey. Mr. K. M. Thomas's wards came out victorious in the finals against Sri. C. R. Srinivasa Ayyangar's wards by scoring a goal in the second half of the extra time.

Inter-class matches. *Victory cup tournament.* The victory cup was annexed by class III by winning hockey and foot-ball events.

Parnel cup. Parnel cup for inter-class hockey, was won by class I after a keen contest with class III.

Award of College colours. The College colours for the year were awarded to the following students for proficiency in various games and sports.

(a) *Athletics.* Messrs. H. Narayana Kamath of class III and Govidaswami of class I.

(b) *Crickets.* Messrs. Monappa Hegde of class III and C. Shankara Rao of class II.

The Maharaja of Travancore Curzon memorial lectures. Under the auspices of the Madras University, Dr. M. Damodaram, Director, Bio-Chemistry Laboratory,

Madras University, delivered a course of three lectures on 3rd, 4th and 5th February 1941. The subject for the lectures, was "The nitrogen metabolism and feeding of plants and animals". The lectures were greatly appreciated and a large number of students and officers attended the meetings.

Visitors. F. Rodrigo Esq., C.C.S., Director of Agriculture, Ceylon, Dr. M. Damodaram, Director, Bio-chemistry laboratory, Madras University, and Dewan Bahadur Sri. T. Ananthachariar, Member, Madras Public Services Commission, visited the Agricultural College and Research Institute during the month.

Personal. Consequent on the leave granted to Rao Bahadur K. T. Alwa, Headquarters Deputy Director of Agriculture, Madras, preparatory to his retirement Mr. T. Budhavedeya Rao Nayudu, Superintendent, Livestock Research Station, Hosur, has been appointed instead. We offer our felicitations to Mr. Nayudu on his well-merited appointment.

OBITUARY

Sri A. Gnanadurai Pandiaraj David. It is with profound regret that we record the untimely death of Sri A. Gnanadurai Pandiaraj David, B. Sc. Ag., Fieldman at the Agricultural Research Station, Pilicode (South Kanara Dt.) of snake bite. Mr. Pandiaraj was as usual returning home after a walk along with his friends when he was bitten by the reptile at about 8 p. m. on the 31st January. In spite of best medical aid and all efforts made by his colleagues to save his life, he succumbed to the effect of the poison on 6th February 1941. Mr. Pandiaraj passed out of the Agricultural College, Coimbatore in May 1939 and was entertained as a fieldman in the Oilseeds Section and posted for work at the Coconut stations. He was a promising young man, intelligent and industrious and was liked by one and all alike. The large number of people who attended his funeral at the Christian Cemetery at Nileshwar bore ample testimony to his popularity. In Mr. Pandiaraja's death the Oilseeds Section has lost an excellent and enthusiastic worker. He leaves behind him his widowed mother and a large number of relations and friends and a band of sorrowing colleagues to bemoan his loss.

Sri Sakkarama Rao. We record with deep regret the death of Sri K. Sakkarama Rao, Head Clerk, Office of the Senior Lecturer and Superintendent, Central Farm, Coimbatore. Born on 22—7—1891, he entered service as a clerk in the Government Mycologist's Office on 1—8—1913. Later on he was transferred to the districts and served as Head Clerk in the Deputy Director's offices in Coimbatore, Trichinopoly, Guntur and Madura. He died of paralysis on 6th February 1941 in spite of best medical aid. He leaves behind his wife, his aged father, a son and a daughter, and many relatives and friends, to whom we offer our sympathy.

Weather Review—JANUARY 1941.

RAINFALL DATA

Division	Station.	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	−0·2	0·0
	Calingapatam	0·0	−0·3	0·0
	Vizagapatam	0·0	−0·5	0·0
	Anakapalli*	0·0	−0·3	0·0
	Samalkota*			
	Maruteru*	0·0	0·0	0·0
	Cocanada	0·0	−0·2	0·0
	Masulipatam	0·0	−0·2	0·0
	Guntur*	0·1	+0·1	0·1
Ceded Dists.	Kurnool	0·1	−0·1	0·1
	Nandyal*	0·0	0·0	0·0
	Hagari*	0·0	0·0	0·0
	Siruguppa*	0·3	+0·2	0·3
	Bellary	0·0	−0·1	0·0
	Anantapur*	0·0	−0·4	0·0
	Rentachintala	0·0		0·0
	Cuddapah	0·3	−0·1	0·3
	Anantharajupet*	0·1	−0·6	0·1
Carnatic	Nellore	0·0	−1·7	0·0
	Madras	0·7	−0·7	0·7
	Palur*	2·7	+1·4	2·5
	Tindivanam*	1·0	0·0	1·0
	Cuddalore	3·3	+1·7	3·3
Central	Vellore	0·5	−1·0	0·5
	Gudiyattam*	0·5	−0·5	0·5
	Salem	0·1	−0·2	0·1
	Coimbatore	0·8	+0·2	0·8
	Coimbatore A. C. & R. I.*	1·4	+0·7	1·4
	Trichinopoly	0·2	−0·5	0·2

Division	Station	Actual for month	Departure from normal @	Total since 1st Janaruy
South	Negapatam	1·7	0·0	1·7
	Aduthurai*	1·2	−2·2	1·2
	Madura	1·4	+0·8	1·4
	Pamban	4·9	+2·8	4·9
	Koilpatti*	1·7	+0·3	1·7
	Palamkottah	1·4	−0·1	1·4
West Coast	Trivandrum	0·9	0·0	0·9
	Cochin	1·7	+1·0	1·7
	Calicut	0·6	+0·2	0·6
	Pattambi*	0·0	−0·2	0·0
	Taliparamba*	0·0	0·0	0·0
	Kasargode*	0·0	−0·2	0·0
	Nileshwar*	0·2	0·0	0·2
	Mangalore	0·0	−0·1	0·0
Mysore and Coorg	Chitaldrug	0·1	−0·2	0·1
	Bangalore	0·2	−0·1	0·2
	Mysore	0·1	0·0	0·1
	Mercara	0·0	−0·2	0·0
Hills	Kodaikanal	4·1	+1·2	4·1
	Coonoor			
	Ootacamund*	1·3	0·0	1·3
	Nanjanad*	0·9	−0·2	0·9

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated up to 1937 (published in Fort St. George Gazette).

Weather was generally dry over the whole area except for one spell of widespread rains over the South between the 7th and 9th of the month and for some scattered showers at the beginning of the month and again between the 18th and 25th.

Rainfall was generally below normal, except in parts of the South Coromandel Coast and in parts of the Coimbatore district and hills.

The chief falls of rain were:—

Cuddalore	3·1″	7th.
Pamban	2·5″	8th.
Kodaikanal	2·0″	7th.
Coimbatore A. C. & R. I.	1·1″	8th.

Weather Report for the Agricultural College and Research Institute Observatory.

Report No. 1/41.

Absolute maximum in shade.	...	90°F
Absolute minimum in shade.	...	56·5°F
Mean maximum in shade.	...	85·5°F
Departure from normal.	...	−0·4°F
Mean minimum in shade.	...	66·0°F
Departure from normal.	...	+1·8°F
Total rainfall for the month.	...	1·37 inches.
Departure from normal.	...	+0·67 ,,
Heaviest fall in 24 hours.	...	1·05 ,,
Total number of rainy days.	...	3
Mean daily wind velocity.	...	1·2 m. p. h.
Departure from normal.	...	−1·8 ,,
Mean humidity at 8 hours.	...	79·9 %
Departure from normal.	...	+3·7 %

Summary. Rain to the extent of 1·37 inches, constituting an excess of 0·67 inches over the normal, was received during the month. The temperatures during the day time were nearly normal while during nights were slightly above normal. The skies were heavily to moderately clouded and the relative humidity was above normal. The movement of air was below normal. P. V. R. & R. S.

Departmental Notifications.

Gazette Notification.

Appointments.

The temporary post of Gazetted Assistant to the Principal, Agricultural College; the appointment of Sri P. Krishna Rao as temporary Gazetted Assistant to the Principal, Agricultural College, Coimbatore is extended from 24th December 1940 till 23rd December 1941 or until further orders whichever is earlier.

Sri P. N. Krishna Ayyar on the termination of his temporary appointment as Parasitologist on 29th January 1941 is appointed to officiate as Assistant Entomologist, Coimbatore in Category 7 Class I Madras Agricultural Service.

Sri S. Ramachadra Ayyar, officiating Assistant Entomologist, Coimbatore on relief by Sri. P. N. Krishna Ayyar, will revert to his permanent post as Assistant in the Entomology Section, Coimbatore in the Madras Agricultural Subordinate Service.

Subordinate Services.

Appointment

Sri. P. S. Narayanaswami Ayyar whose present officiating appointment in the Entomology section terminates on 29th January 1941, will continue to officiate as Assistant in the same section from 30th January 1941 to 28th February 1941 vice Sri. M. S. Kylasam granted leave.

insect resembling the locust he will be well advised to communicate the news and send the specimen to the nearest Agricultural officer or to the Government Entomologist, Coimbatore, for confirmation.

The 'Project' system in Agricultural Propaganda. One important criticism levelled by competent observers against the work of the Agricultural department in India is that the knowledge gained by the research worker is not promptly conveyed to or adequately utilised by the Indian farmer, with the result that the gulf between the experimental stations and the farmer's holdings remains unbridged. That the truth of this criticism is being increasingly recognized by Provincial and State departments of Agriculture in India is evidenced by the trend of discussions which of late has centred round this theme at the meetings of the Imperial Council of Agricultural Research, Indian Central Cotton Committee and Provincial Agricultural Associations. There is a general consensus of opinion in the country that the 'Project' method which has met with marked success in the work of the Soil Conservation Service of the U. S. A. would be the most suited for Indian conditions. We are glad to note the Imperial Council of Agricultural Research has invited definite 'Project' schemes from the Provinces and constituent States and are planning to launch model schemes in the course of the next year.

The basic idea of a 'Project' is to select a group of contiguous holdings in which *all* the known agricultural improvements of proved value and suited to the area are applied simultaneously or in close sequence by the cultivators themselves, the department merely providing the advice and the essential assistance. The merit of an ideal 'project' lies in the planning of a system of land utilisation as a means of permanently improving the cultivator's land, his practices, his social environment and above all, his income. In this respect the 'Project' system is a departure from the time-honoured 'demonstrations' on a farmers' holdings where only one item of improvement was demonstrated at one time.

It is a matter of satisfaction to us that agricultural propaganda in Madras has undergone substantial reformation in recent years. The 'Central village' system adopted in 1930 is in essential features based on the 'project' method, though there is room for further improvement. To our mind, the 'Central village' system of the Madras Agricultural Department has been too narrowly agricultural. Schemes of improvement are almost exclusively confined to such aspects as the building up of soil fertility, conservation of manures, the adoption of improved methods of tillage and the use of superior strains of seed. 'Stock farming' as a balanced adjunct to 'land farming' has not received as much attention as it deserves. Subsidiary industries and organisation of social amenities in the Central villages are still in need of greater attention. Since, however, Madras has already gone halfway with the 'project' scheme, it should be easy to improve on the existing system and bring it in line with full-fledged projects, the success of which the shrewd Madrasi ryot will not fail to appreciate.

Cultivation of Sivapuri Tobacco

By C. S. KRISHNASWAMI, L. Ag.,

Agricultural Demonstrator, Chidambaram.

Sivapuri tobacco, is well known throughout South India and is considered as the best among the varieties grown for chewing. The same variety when grown in other places is not considered as good as the stuff grown in this village. This is attributed to the quality of the soil. Sivapuri village, is about two miles from Chidambaram Railway station and consists mostly of 'wet' lands irrigated by channels from the Coleroon river. Except for a limited area round about the village site, about 120 acres in extent, there are no other 'garden' lands, and the entire area is cultivated with this variety of tobacco.

Details of cultivation. (i) *Soil.* The soil is a sandy loam, become rich in humus due to heavy manuring every year with cattle manure and village and town rubbish. It is also rich in potash and the colour is grey. The cost of this type of land, ranges from Rs. 4000 to Rs. 8000 for an acre, but very few are willing to part with it, since they fetch a good amount Rs. 200 to Rs. 250 per acre when leased out. The assessment for such lands, however, varies from Rs. 2 to Rs. 3 per acre.

(ii) *Rotation.* In this area, tobacco is raised every year from November to April. No rotation is practised. The lands remain fallow during the remaining months. The cultivators are of opinion that if any crop other than tobacco is cultivated, the quantity and quality of the cured leaves will be affected.

(iii) *Seed bed.* Raising vigorous and healthy seedlings requires great skill and care. High level lands with good drainage are selected near a pond or a well for raising the nursery. It is dug to a depth of about 9 inches to 1 foot with *mammutties* twice or thrice till the soil attains fine tilth. About two cartloads of well rotten cattle manure are evenly spread and incorporated into the soil. The surface soil is levelled and small beds are formed. One to one and half *tolas* of good tobacco seed, collected from the previous year's crop is sown mixed with one pound of fine sand. The mixture is evenly sprinkled twice or thrice to ensure uniformity. The seed-beds are then pressed with the palm of the hand to compact the soil. Water is sprinkled by means of a rose can and the beds are covered with plaited coconut leaves. The seed beds are watered regularly, both in the morning and evening for a week. The seeds begin to germinate by that time and the shade is removed. For the next 24 days, the beds are watered once a day generally in the evening. The beds are carefully hand-weeded twice or thrice during this period. Sowings are generally done from the middle of October to the middle of November. The seedlings will be ready for planting in about 40 days, after sowing.

(iv) *Preparatory cultivation.* After the harvest of the tobacco crop in April, the fields lie fallow till next September. Not less than four or five ploughings are given with a fairly big sized country plough in September. In October or November, just a few days before planting, the land is thoroughly dug with *mammutties* to a depth of about 9" to 12".

(v) *Manuring.* Nearly 60 tons of well rotten cattle manure and wood ashes are applied to one *Kani* (1·33 acres) of land from April to September. Not less than Rs. 100 is spent in manuring alone. Ammonium sulphate and oil cakes were tried by a few ryots but were found to produce poor quality leaves.

(vi) *Planting:* After thoroughly preparing the land and just before planting, parallel lines 3' to 3½' apart are marked out both lengthwise and breadthwise. If the soil is rich, 3½' spacing is adopted. At the crossings of these lines holes are made with small tapering pegs, enough water is poured and vigorous, well grown seedlings are planted, one in each hole. Green leafy twigs are planted beside each seedling, to provide shade till it is established. Planting is done only in the evening after 4 p. m. About 5000 seedlings, are required for one acre. Pot watering is continued for about 40 days, after planting.

(vii) *After cultivation and irrigation.* Within 40 days, four hoeings are usually given at intervals of about a week beginning from the second week. The first hoeing is given round the plants with a pointed bamboo stick. Other hoeings are given with *mammutties.* The soil is thus kept in a very fine condition entirely free from weeds. After the final hoeing, beds and irrigation channels are formed enclosing four to six plants in each bed. From the 40th day the crop is irrigated once every alternate day. When the plants are about 70 days old they put forth flowers. Only three to four plants for each *Kani* are allowed to flower and set seed while the rest are 'topped', leaving 12 to 14 leaves per plant. The side-suckers are regularly removed. Each plant is individually examined for insects and remedial measures are adopted as soon as they are noticed. Another *mammatty* hoeing is given about the 80th day. To avoid injury, the spreading leaves are tied round the stem with '*paddy straw twist*' and hoeing given around the plants. The leaves are untied after the operation. For about 10 days after the final hoeing, irrigations are given daily and later the crop is irrigated on alternate days till it is harvested.

(viii) *Pests and diseases.* There are no serious fungus or other diseases affecting this variety. Plant lice (*Myzus persicae*) and tobacco caterpillars are the major insect pests invariably found every year. When plant lice make their appearance, a paste made of *neem* (*Aziderachta indica*) oil cake sweet flag (*Acorus calamus*) and chilli (*Capsicum annuum*) powder is smeared on the leaves with the aid of a crude coconut fibre brush. About 20 lbs. of *neem* cake, 3 lbs of chilli powder and ¾ lb. of sweet flag rhizomes are required for treating plants in one acre. Irrigation is withheld for the next

two days. The affected leaves wither along with the insects and the pest is thus kept in check. The leaf eating caterpillers are regularly hand picked in the morning before 8 a. m. No special labour is engaged for picking them or for applying the paste as the regular coolies engaged for the cultivation do these operations with-out any extra remuneration.

(ix) *Harvesting*. The crop is ready for harvest in about 120 days after planting. The drying of lower leaves and the appearance of the oval shaped spots called '*Mohar*' on the top leaves indicate that the crop is mature. The leaves are thick and gummy at that time. On any convenient day, not exceeding 125 days after planting, the plants are harvested in the evening about 4 p. m. by cutting the whole plants at the bottom of the stem They are left in the field in an inverted position thoroughout that night till about 8 a. m. on the next day.

(x) *Curing*. The next morning the plants are collected, stored in small heaps and covered with straw till about 4 p. m. Again they are spread out in the field till next morning. This sort of sun curing is continued for a week. The plants are then removed and hung in the shade without touching each other. This method of shade and air curing continues for a week. At the end of the period the plants are removed and the leaves cut off with a portion of the stem attached to the leaves. The central core of the stem is generally rejected. While stripping, the leaves are carefully graded. The top four leaves are generally graded as "class I". The next three or four form "class II". The next three or four form "class III" and the remaining ones which are usually brownish and withered, form "class IV". The classification is generally based on the thickness and weight of leaves, and '*Mohar*' marks on them. Five leaves in each sort are tied together into a sheaf and 40 sheaves form a bundle.

These sheaves are arranged in the form of a rectangular heap in shade where there is not much draught. The bottom, sides and the top of the heap are covered well with dried tobacco leaves and pressed down with wooden logs and left undisturbed for a week to nine days. The heap is rearranged at the end of that period; and allowed to remain so for another week. The sheaves are then removed and allowed to dry in the shade for nine or ten days. The leaves will be sufficiently dry by then and will be ready for marketing. They are packed into bundles covered with mats and stored in a dry, cool place, till they are disposed. About 14 to 16 bundles with an aggregate weight of about 2000 lb. are obtained from an acre.

(xi) *Marketing*. The leaves are sold in terms of bundles only and not by weight. Each bundle contains 2400 leaves. A bundle of "class I" leaves weighs 150 to 170 lbs, "class II" 120 to 130 lbs, and "class III" leaves only 100 to 110 lbs, per bundle. The last class leaves are very poor in quality and do not weigh more than 70 to 90 lbs, per bundle. The chief market for the "class I" leaves is Chettinad. Merchants from Karaikudi and other towns in that area advance money to the cultivators and purchase the cured leaves in May—June. Till very recently there

was considerable demand for Sivapuri leaves. Of late, and especially during the last two years the market is dull. Tobacco leaves are being sold nowadays in small packets in retail. It is reported that tobacco grown in Sivapuri is adulterated with tobacco grown in other parts and sold in retail as 'Sivapuri' tobacco.

Cultivation charges for one acre.

Expenditure.	Per acre. Rs.	As.
1. *Nursery*:—		
Preparing the nursery	0	8
Cost of 2½ cart loads of cattle manure	2	8
1½ tolas of tobacco seed	0	12
Pot watering for a month	0	12
2. *Main field preparatory cultivation*:—		
Ploughing with country plough, 4 times @ Rs. 1—4—0 per ploughing	5	0
Digging with *mammutty* to a depth of 1¼' 24 men @ 5 as. ...	7	0
3. *Manures and manuring*:—		
Carting 45 tons of cattle manure from Chidambaram and the neighbouring villages including carting charges @ Rs. 2 per ton	90	0
Spreading the manure evenly	3	0
Planting the seedlings in lines 3½' apart	10	0
4. *After cultivation*:—		
Hoeing with *mammutties* at intervals, 4 times... ...	32	0
Suckering, topping and treating the affected plants ...	6	0
5. *Irrigation*:—		
Fitting up *Picottah* for irrigation	2	0
Renewing leather rope bucket etc.	4	0
Lifting water once in two days for 4 months	64	0
6. *Harvesting*:—		
Harvesting, curing and grading, 4 men @ Rs. 8 each ...	32	0
Rent for the land (one acre)	250	0
Total expenditure ...	510	0

5 men on Rs. 8 per mensum are engaged for each *Kani* for about 5 months. All the above mentioned operations including the curing are done by them. No casual coolies are engaged for any of the operations.

Receipts.

The value of the cured leaves is:—

10 bundles of	"class I" leaves @	Rs. 60 per bundle	Rs.	600	0
2 ,,	"class II" ,,	Rs. 30 ,,	Rs.	60	0
1 ,,	"class III" ,,	Rs. 20 ,,	Rs.	20	0
1 ,,	"class IV" ,,	Rs. 10 ,,	Rs.	10	0
			Total Rs.	690	0

Net gain per acre Rs. 180.

The Place of Advertising in the Activities of the Agricultural Department.

By R. RATNAM, B. A.

Introduction. Criticisms on the usefulness of the Agricultural Department are frequently heard sometimes from the educated men of our Province often due to unfounded notions or lack of adequate information on the various activities carried on by the Department. These criticisms are properly answered when they reach the ears of the departmental officers and the critics are almost invariably converted on being furnished with sufficient information. However, there is the danger of such unfounded criticisms passing on from person to person and thus acting as a potential source of prejudice against departmental activities. To avoid the spread of such an evil germ which, if not checked at the proper time may gain undue momentum, adequate measures have to be taken, and the Department has to pay special attention to the dissemination of sufficient information to the public. At present the Department is holding exhibitions and lectures and distributing leaflets and pamphlets and issuing press notes. While they educate the public on agricultural improvements, they also serve to correct these wrong opinions and to create a more favourable public opinion. But one has to seriously consider whether these comprise the maximum effort that the Department could put forth and whether the Department cannot do anything more. In the following pages the scope of proper advertising in all its aspects as a remedy for this evil is indicated.

What is to be Advertised? With the Department is available not only some commodities such as seeds, implements, books and publications, but also a lot of service information in respect of agricultural practices. It appears reasonable to classify such services and commodities to be advertised into the following groups :—

1. *Policy and Programme of the Department.* In this group can be included the information contained in the administration report of the Department issued every year. The information is in respect of investigations in progress with the Department on its research branch, and also a resume of the work carried out by the propaganda wing. The progress achieved during a given year in various fields of research and propaganda as compared with similar progress during the previous year is also included. At present these particulars are contained in the publication entitled *Report on the Operations of the Department of Agriculture* which is available to the public and is priced about eight annas. The Government's review of these operations is appended to this publication. This review also appears in the Press. Unfortunately the public does not seem to be keen on purchasing this publication, its interest rarely going beyond a perfunctory perusal of the Press Review. Being an annual review, the activities of the Department are often lost sight of by the public. There seems to be an

imperative need to recount to the public the activities of the Department more often than once a year, say, at least every three months. An advertisement through a proper medium seems to be urgently called for in this regard.

2. *Recommendations for improved cultural, manurial and other practices.* Data on these aspects are accumulating with the Department as a result of investigations made year after year. Departmental leaflets, pamphlets and other priced bulletins contain a wealth of information in this regard. These are distributed to the public mainly through the the agency of the Agricultural Demonstrators. Still there seems to be a feeling with the public that their distribution is not adequate. Moreover, as advertisers in commercial fields do, it appears necessary to write leaflets to flatter the reader into believing that he was badly in need of the agricultural improvement which is the subject matter of the publication and that the investigation is just the thing that the reader wanted badly. In this group of advertising matter, may be included all the recommendations of the Department such as preservation of cattle manure, prevention of soil erosion, control of pests, proper grading and marketing of produce etc.

3. *Stimulating internal consumption of agricultural produce.* The present war has created some very distressing situations in the internal economy of our country which is predominantly agricultural. Our erstwhile markets in Europe and other western countries for our produce, particularly for our oilseeds, cotton etc., have been cut off. The need for stimulating internal consumption of some of these products and their by-products in industry has become urgent. Here is a fertile field for propaganda activity. The agriculturists are too poor and ignorant to be vociferous enough to stimulate internal consumption. The Department may take up their cause and by proper advertising in this respect relieve the distress of the agriculturists at least to some extent.

4. *Agricultural planning.* While propaganda in respect of group (3) relates to the present and immediate future, perhaps the Department has on its anvil some kind of agricultural planning with a view to divert where possible the area under one crop to another crop which is already grown in the Province or to some new crops which could be grown. For instance, so far as existing waste lands are concerned, the Department is already advocating cashewnut cultivation in them. Further, the shortage of coconuts in India calls for the extension of cultivation of this crop wherever possible. Such recommendations need considerable advertisement.

5 *Sale of seeds, implements and books.* At present the sale of these articles is effected through the agency of the Agricultural Demonstrators. There has been very little advertising for many of these, and as such their existence is not known to a vast majority of the public. If it is felt that the total quantity of seeds multiplied at Government farms is inadequate to meet the demands for seeds from all over the Province, it may be necessary

for the Department to run seed farms. The hearty co-operation of some of our enlightened ryots is badly needed in this line. Effective advertising would help the Department a great deal.

Medium of Advertisement There are several media through which advertisements may be issued and notice will be taken of the following:— (1) Newspapers, (2) Magazines, (3) Direct mail, (4) Radio, (5) Sign-boards, and (6) Films. The merits of each from the point of view of the Department are discussed below: —

(1) *Newspapers.* Since the purpose of advertisement to be issued by the Agricultural Department is intended not only to educate the general public as to what is happening in the Department but also to instruct such of the cultivators as are literate about the recommendations of the Department, newspaper may serve as a very good medium. This form of advertisement would reach the largest number of people The five groups of advertisements mentioned earlier could well be fitted into newspapers. The advertisements may be crisp and short at the beginning Press notes and leaflets may be issued later detailing some of the investigations of the Department. For instance, the following types of advertisement are useful.

YOUR WASTE LANDS SHOULD GIVE YOU PROFIT

Grow *CASHEWNUTS* and have a sure return

Seeds can be had from your Agricultural Demonstrator

YOU'LL LIKE IT

GROUNDNUTS for munching

A substantial food—Rich in proteins

Eat more GROUNDNUTS

It may be necessary to have not only these advertisements effectively displayed in an important position of the paper but to have more than two insertions for each.

2. *Magazines.* Magazines command a very limited circulation in our country and cater only to particular tastes. Except a few Indian language journals, the others have very limited scope as advertising media for our Department.

3. *Direct Mail.* By direct mail, letters, cards, folders, booklets, leaflets etc., are posted to selected individuals. A proper mailing list of enlightened people who are agriculturally inclined can be drawn up by the Department by taking stock of the enquiries from private parties received by the various offices of the Department. This mailing list may be classed into various groups according to the nature of the crop grown in each tract wherein each addressee resides or owns lands. Such a grouping would

enable the Department to select the literature that should go to each addressee. The flexibility and selectivity of direct mail advertising are unsurpassed by any other medium. This line of advertising deserves special notice as its appeal to the public is direct and effective. Although its chief drawback in the Department is its relatively high cost by way of postage yet such literature could be mailed to selected addresses.

4. *Radio.* The possibilities of using radio as an aid to advertising has gripped the imagination of many. But its limitations, particularly in our country, are several-fold, more particularly on account of the multiplicity of languages. Moreover the number of receiving sets in our Province is few, and therefore the number of radio listeners is negligible compared to the population of the Province. Studies conducted in western countries indicate that appeals made through the sense of hearing are more lasting and effective than appeals made through the visual sense. Nevertheless, in our country what is gained in quality by radio advertising is lost by the paucity of the number of people who receive the message. In this Department there seems to be an imperative need to think of numbers rather than quality. At present advertisements of the Department are relayed by means of music, drama, and dialogues, for about 15 minutes every day between 6 and 7 p. m. Despite present defects, radio propaganda is becoming increasingly effective and should be continued.

5. *Signboards.* It appears that showy signboards and posters are not being used in this Department in any extensive manner though a few posters exist and some are put up at exhibitions. The possibility of a very much larger use of posters deserves to be seriously considered. The advantages of poster advertising are severalfold. Signboards are mobile and can reach any place. They concentrate attention very easily by virtue of their position, size and perhaps striking colours. They should be as simple in design as they are sure of attention. Signboards can be put on roadsides, on railway platforms and in trains, while those on motor buses ensure novelty and attention. Signboards in such places as Sub-treasuries, Registration and Judicial Offices would attract considerable attention from a large number of people from villages.

6. *Films.* The role of films as a medium of advertising has been fully recognised in all countries. A carefully planned set of short films which can be thrown as interludes before the usual programmes will go a long way to ensure popularisation of the work of the Department.

The foregoing discussion would indicate that the Department could consider the feasibility of taking to some of the above media more extensively for advertisement purposes. From the point of view of effectiveness, it is perhaps correct to state that at present signboard advertising would come first followed by newspaper advertising and lastly direct mail, though the last mentioned would entail perhaps relatively more cost merely by way of postage. It seems desirable to chalk out an advertisement programme spread over three or more years and watch the results carefully.

Educate the young. The need for creating an agricultural bias even with school children has been realised by our educationists for quite a long time and in a few schools agriculture is included in the curriculum of studies. It is desirable that this principle is extended for the use of Departmental propaganda as well.

There are about 700 High Schools in the Province. Every year about eight to nine thousand pupils pass their S. S. L. C. or Matriculation. These young men are the citizens of tomorrow and there is no reason why Departmental propaganda should not start with these high school leaving pupils. The free supply of a handsome copy of the Bible or the Gita when one takes a degree of a University may be copied, and attractively bound copies of the *Villagers' Calendar** may be supplied to high school leaving pupils The *Villagers' Calendar* would serve as a good advertisement with the boys' families as well. Perhaps this would result in future increased sales of the *Villagers' Calendar*.

In addition to the distribution of literature, it is necessary that agricultural exhibitions are held in High Schools also. The Demonstrators may deliver popular lectures on some topical subjects to the students A programme of various subjects may be drawn up, and different subjects may be dealt with in different tracts. The subjects may be changed every year, and the results watched. Experiences of Demonstrators dealing with a particular subject may be pooled together after the close of the lectures, and the gist of the lectures perfected as much as possible before passing the subjects on to the next demonstrator. This may be a new experiment and the results require to be watched after execution.

Financial considerations. The following estimate with slight modifications may be adopted as probable expenditure.

Expenditure per year.	Rs.
Preparation and printing posters and erection of signboards ...	10,000
Newspaper advertising	3,000
Cost of *Villagers' Calendar* for distribution to pupils ...	750
Cost of printing folders, new literature etc.	750
Other miscellaneous charges	500
Rs. ...	15,000

At first sight the sum of Rs. 15,000 provided for an advertisement programme may appear fabulous. In fact it works out only to about 0·7 per cent of the total expenditure of the Department. It is estimated that on the propaganda side the Department incurs not less than 4 lakhs of rupees and perhaps much more, and the estimated advertisement charges would amount to less than 4 per cent of this sum.

It may be asked whether success for this advertising programme is assured particularly when the percentage of literacy in our country is so low. The Department appears to have benefitted the ryots by the distribution of leaflets in spite of the large percentage of illiteracy in our country.

* A publication of the Madras Agricultural Department, priced one anna.

The advertisements envisaged in the foregoing pages merely make the appeal to ryots more intensive and extensive, and is to be followed up by the increased use of leaflets and press notes.

What other Government and quasi Government departments do. It does not also appear that the advertisement programme chalked out above is novel or revolutionary. There are a number of other Departments (particularly under the Government of India) which are utilizing advertisements to aid Departmental activity. The products of the Kerala Soap Institute, Calicut are well advertised. The Posts and Telegraph Department advertises its services with remarkable efficiency. The Imperial Council of Agricultural Research issues a number of posters and folders for advertising its publications. The Imperial Bureau of Plant Genetics in England has also issued a number of posters and mimeographed bulletins advertising its publications. *Indian Information* published by the Government of India is another example of how journalism has been harnessed for purposes of Departmental propaganda. Its flashing headlines and attractive summaries are an object lesson for Government advertisers. The Broadcasting Stations at Madras and Trichinopoly give a summary of a week's programme ahead of time through the medium of the newspapers.

A Central Agency for issuing popular publications and compiling advertisements. Departmental leaflets are intended as media for conveying information about particular recommendations made by the Department. Their prime object is to instigate cultivators to follow the recommendations made in the leaflets. The message contained in the leaflets should be couched in simple language, and end with a definite plea asking the reader to do a particular thing. Headlines in the leaflet should be catchy and the entire message should retain the reader's attention.

The present day manner of editing newspapers reflects the tastes of the public. Flashing headlines summarising news and reports are the order of the day. The very first sentence or paragraph of the news usually summarises the gist of the news. The compilation of such headlines and summaries no doubt requires some skill and special training. Similarly compilation of advertisements has become a special science. Separate technique for editing effective advertisements has been evolved. The Department has to take note of these facts also before launching an advertisement programme.

The practice at present obtaining in the Department seems to be that the author of every investigation writes his own leaflets. This appears to have resulted in numerous leaflets, each having a differing degree of appeal to the public proportionately to the skill of the author in writing popular leaflets. If the leaflets are to be effective, it appears necessary that the scientist should combine in him the qualities of the journalist as well. It is for consideration whether the Department cannot have a small trained Central Agency for editing popular literature and posters with the

material furnished by the investigating officer. Commercial concerns always seek the help of special advertising agencies for writing their advertisements. This would relieve pressure on the time of the scientist. After editing by the Central Agency, the draft of the popular publication or advertisement may be sent back to the author for approval before releasing it to the Press.

Co-operative Marketing of Sathugudi Oranges.

By T. K. VISWANATHAN, B. Sc. Ag.

The Kodur Fruit Growers' Co-operative Society, Rajampet.

The production of Sathugudi oranges in South India is at present concentrated in parts of Cuddapah, Chittoor and North Arcot Districts. But nowhere has it attained such a great commercial importance as in Rajampet taluk of Cuddapah District, particularly in and around Kodur town. It has been estimated that out of a total area of about 13,000 acres under 'tight jacket' orange, about 4,000 acres are spread out in a small valley in Rajampet taluk bounded by the Velikonda hills on the East and South and Seshachalam hills on the North and West. This tract is favoured by a fertile soil of considerable depth and good texture, a plentiful supply of sub-soil water suitable for irrigation, freedom from cyclonic winds and proximity to markets, factors eminently suitable for making this valley so renowned as the leading orange belt of South India.

The estimated production of oranges in this tract is at present of the order of 50,000 railway maunds, of which well over 45,000 maunds are believed to be exported annually outside the district, primarily to Madras city. This production represents the crop of only about 40 per cent of the planted area, as the rest of the orchards are yet young and in a non-bearing stage. With the present trend for rapid extension of orange plantings and the consequent increase in the bulk of marketable oranges from such new plantations in the near future, the problem of profitable disposal of the crop is bound to assume very great importance Already there are complaints that the price of oranges is showing an abnormal tendency towards deterioration, so much so that the fruit is being quoted during the peak season in retail market at Madras at about Rs. 2 per hundred as compared to Rs. 4 to 5 during the corresponding season about three years ago. To attribute this alarming fall in price to over-production will be a travesty of facts, for the Presidency is not only a big importer of 'Santra' oranges from Coorg and Nagpur, but is also suffering from an under-supply of *Sathugudi* or allied type of 'tight jacket' oranges in most of the mufussal markets and almost all towns other than Madras. The haphazard method of distribution and defective system of lease of orchards and of marketing of fruits are believed to contribute mainly to the prevailing slump. Such features serve only to accentuate the ills and hasten the ruinous condition of the orange industry as the younger plantations continue to add increasing quantities of saleable produce every year.

The Sathugudi-growing valley of Rajampet taluk is also reputed for the production of a number of varieties of mangoes and also limes. The total area under mangoes in the taluk is estimated to be about 10,000 acres. Unlike oranges, however, the major portion of mangoes produced in this tract finds its way to Hyderabad (Dn) and Northern India markets instead of to Madras city which, because of their proximity, is naturally fed by the mango plantations in Chittoor district. Despite the absence of any clash of interests between the marketing problems of Sathugudi and mango, it is however found that the methods of assembling, financing the crop and its transport, methods of sale of standing crop and of disposal at the primary markets and place of production are almost identical in these two fruits, so that any improvements effected in the marketing of one fruit are bound to react favourably on the other as well. This fact necessitates the adoption of a co-ordinated policy in any effort for the profitable disposal of all fruit crops in this intensively fruit-growing tract.

A noticeable feature of fruit production in Rajampet taluk, as perhaps in the rest of the Presidency, is that the orchards comprise of small holdings of an average size of half-an-acre. The orange orchards in the taluk are therefore owned by a large number of small peasant farmers and a few well-to-do ryots The former class of people is proverbially indebted, while a good number of the latter class has also to depend for temporary finacial assistance on extraneous sources at least during the harvesting periods. In a perennial crop like fruit which involves several years of patient waiting for returns, an injudicious grower is apt to overlook the golden principle of "cutting one's coat according to the cloth". Consequently, after about 10 years of nursing the young non-bearing orange plantation, the grower is usually faced with a pile of debt which he hopes to clear with the sale of his crop during the bearing period, commencing from about the eleventh year. Even during the latter period he should have ready capital for meeting the high annual cost on irrigation, manuring, watching and also on packing and transportation. After he has cleared the various loans borrowed for meeting these sundry annual expenditure, it is very rare that he has a surplus balance for clearing his original debt contracted during the non-bearing period of the plantation. Thus the average Sathugudi planter is anything but a contented person.

The aforesaid peculiarities provide a most profitable ground for giving full play to the wits and ingenuities of some unscrupulous middlemen and their dishonest commission agents. The writer does not suggest that all middlemen and commission agents are unscrupulous enemies of the grower; as a matter of fact, many growers acknowledge with gratitude the considerable financial help received from this class of financing businessmen in times of their dire need and but for which the growers would not have been able to tide over their acute periods of distress and even convert their plantations to veritable sources of profit in due course. Notwithstanding such instances, the fact cannot be gainsaid that, the fruit industry in Rajampet

taluk has come to what it is, almost entirely due firstly, to lack of suitable system of financial assistance, secondly, to individualistic efforts of the growers and thirdly, to the chaotic method of disposal of the produce in primary markets.

The disorganised state of the fruit industry in the taluk stimulated thought among some of the leading growers and drove them to adopt concerted efforts for bettering their lot. The inception of a Fruit Research Station at Kodur during 1935 helped a great deal in providing the growers with suitable advice at this period and in guiding their efforts through right channels. During 1935 and 1936, a number of meetings were convened at Kodur when several proposals for improvement of fruit industry through co-operative effort were discussed by some of the leading growers and the Government Officials of the Co-operative and Agricultural Departments. Ultimately on 17--4—1937, the Kodur Fruit Growers' Co-operative Society saw the light of the day and was officially inaugurated by the Collector of the District.

Since its inception in 1937, this society has been able to claim a very great and all round progress, so much so, that it is now recognised to be a unique and the only successful body in the line in the whole of India. A measure of its achievements cannot be adequately presented in the purview of a small article like this, but nevertheless, the following figures will serve to give a brief idea of the progress achieved during its short existence.

TABLE I. Quantity of fruits marketed.

Year.	Oranges.	Mangoes.	Limes.	Sapotas.	Total No. of baskets.
			(in baskets)		
I. 1937—38.	9,258	651	364	...	10,273
II. 1938—39.	20,376	1000	704	85	21,165
III. 1939—40.	30,823	292	399	104	31,618

TABLE II. -Progress of the Society from date of starting.

Year.	No. of members.	Share capital paid up.	Borrowing from Cuddapah Central Bank.	Loans issued.	Value of fruits exported.	Profit or loss.	Commission earned.
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1936—37	25	1,535	Nil	Nil	Nil	53 (loss)	Nil
1937—38	108	2 795	35,115	42,635	30,004	853	1,405
1938—39	173	4,325	49,889	62,025	83,175	1,800	5,270
1939—40	230	6,156	27,559	32,405	89,775	(not audited)	5,610

The Society has got its headquarters at Rajampet and a branch at Kodur. Ungraded fruits are at present consigned to the Madras Provincial Co-operative Marketing Society at Madras, which after grading disposes off

the fruits quickly. The Marketing Society also despatches oranges by arrangement to various centres in Southern districts such as Trichinopoly, Tanjore and Madura according to demand. A commission of Rs. 0—1—0 is charged for every rupee of gross sale by the Fruit Growers' Society, of which one-fourth of the commission is paid at present to the Provincial Marketing Society.

The Society has been able to exploit new markets and thus widen the distribution of Sathugudi oranges, and by this means has been rendering a very valuable benefit to the orange industry as a whole. Paid representatives are now posted by the Society at (1) Anantapur, (2) Hindupur, (3) Hyderabad (Deccan) and (4) Bangalore. Through posters, hand-bills, articles and advertisement in the press, a vigorous drive towards popularisation of oranges in the daily diet of the people has also been taken up.

Grading of fruits was tried and the result has been sufficiently encouraging as to enable the adoption of the sale of graded fruits in a number of South Indian markets. The society has achieved a big success in creating a demand for graded fruits from moffusil co-operative societies. It was only after the society was started that grading of oranges was taken up. Now the demand from moffussil centres is only for graded and standardised oranges. The society intends starting grading stations with orange grading machines at important fruit producing areas in Rajampet Taluk, and consign such graded oranges directly from production centres to consuming areas, which seems to be the most logical and economical way of marketing oranges. Through this innovation and wide publicity, the consumers have been educated to demand more and more graded fruits of standardized quality.

Two spraying machines have been ordered by the society for meeting the demand of its members for controlling pests and diseases in their orchards. Co-operative purchase of growers' requirements, particularly in the matter of purchase of fertilizers is being attended to. With the loan of the services of a Junior Inspector who is a graduate in Agriculture, for a period of 15 months during the initial stages of work of the society, advisory work in the maintenance of orchards has formed a useful line of activity. This officer serves also as a link between the Fruit Research Station, Kodur and hundreds of fruit growers. In due course, a number of other useful lines of works for the effective improvement of growing and marketing sides of Sathugudi orange industry are also expected to be undertaken.

Co-operation in relation to fruit growing and marketing is novel, in so far as this province is concerned. It is therefore not surprising that the success achieved by the Kodur Fruit Growers' Co-operative Society has attracted wide attention and several requests for the bye-laws of the Society and for advice on the organisation of similar societies elsewhere have come in both from within the province and outside. The following extracts of the bye-laws of the society may therefore be not without interest.

Objects.

Bye-law 2. The objects of the society are :—

1. To encourage self help, thrift and co-operation among members,

2. to act as agent for the joint purchase of agricultural requirements of the members,

3. to teach members improved methods of cultivation of fruits and to supply seed material, manure, nursery plants, grafts, implements etc. for growing fruits,

4. to arrange to sell the fruits grown by members to the best advantage

5. to undertake such other activities as are incidental or conducive to the development of fruit growing by demonstrations propaganda etc., and

6. to give to the members advances to afford facilities to members to the growing and marketing of fruits grown by them.

Business of the Society.

Bye-law 39. It shall be the duty of the board of directors to arrange for the sale of the fruit or other products of members to the best advantage at places of consumption. Any member who fails to transact his produce through the Society shall be liable to a fine in the first instance which the Board of Directors may impose. If the failure is persistant the member is liable for expulsion by the general body.

Loans.

Bye-law 43. Temporary advances may be given at the rate of not exceeding $6\frac{1}{4}$ per cent as determined by the Board of Directors from time to time when necessary for a period of 12 months to afford facilities to members to grow and market fruits or to liquidate petty debts previously incurred for that purpose. Every such advance must be supported by the pledge of the standing crop belonging to the member together with the collateral security of at least one solvent surety. The amount of advance shall not exeed 40% of the then market value of the estimated out-turn. When the return of the advance is not made within 12 months the Board of Directors shall take steps to recover the amount irrespective of the above period at any time if such a step is deemed necessary by taking action as laid down in bye-law 51.

Bye-law 44. Loans may also be given to members on the security of their deposits, on the security of Government securities, or on the mortgage of un-encumbered immovable properties of the members up to 60% of their value when such loans are required for such useful purposes that will improve the growing of fruit trees. Interest on such loans shall be charged at $7\frac{1}{2}\%$.

In the organisation of this Society and in every branch of its activity the Co-operative and Agricultural Departments (particularly the Marketing Section and Fruit Research Station, Kodur) have undoubtedly played the leading role. Among the members, the moving and dynamic spirit for the success of the Society has been that of the Secretary, Sri. V. R. Satyanarayana and the President, Sri. P. V. Pattabhi Rama Reddy.

SELECTED ARTICLE

The Manufacture of Humus.

By H. M. L.

It has been the lot of the present writer during the last few years, and with greater emphasis, perhaps, during the last few months, to draw attention to the importance of humus in the agricultural cycle. If, in so doing, he may appear to have strayed from the relatively restricted field of sugarcane cultivaion into the wider field of general agriculture, apology for such errantry will hardly be needed. The reasons are two; in the first place, the problem of the maintenance of soil fertility here involved is itself a general one, common to all crops; in the second, the tendency. if there be such in the sugar industry, is away from the humus and in the direction of a growing use of artificials. It has been necessary, therefore, to derive examples mainly from the experience obtained in the cultivation of other crops.

In these references there has, perhaps, been too great an acceptance of the fact of the existence of a substance termed humus and too little attention paid to what humus is and how it is prepared. That omission it is here proposed to remedy in as far as so complex a subject can be dealt with adequate brevity.

Humus, then, is not a chemical entity capable of being described and defined in a chemical formula showing so many atoms of the different elements within a characteristic molecule. It is an aggregate of different chemical compounds varying widely from sample to sample, but an aggregate of which all the samples having these points in common; a common mode of origin and certain common physical and chemical properties. The residues of living organisms, in the process of decomposition, pass through a series of natural changes which result, in the production of a relatively stable body, and it is to this body that the term humus is applied. A halt is thus called in the passage of these residues from the highly complex organic substances of the body immediately after death to the simple inorganic substances, water, carbon dioxide, nitrogen and nitrogenous salts and so on, which form the ultimate products of decomposition. It is this natural halt which plays such a vital role in the maintenance of fertility. The more important properties characteristic of this relatively stable product are, on the chemical side, and acidity which cause it to react with the mineral elements of the soil and which is responsible for the liberation of potential plant food, and a carbon nitrogen ratio of approximately 10:1. On the physical side, humus has a high retentive capacity for moisture, acts as a cement causing the smaller soil particles to form aggregates and thus aids the movement of both water and air in the soil. But it is on the biological side that its properties may be found to have the most important effect through the mycorrhizal association which has only recently been recognized as of general occurence.

From the above description of the nature of humus it follows that, since all living organisms ultimately die, the source of humus is as varied as organic nature itself. Herein lies the first difficulty in offering a concise series of instructions on the lines of Mrs. Beeton for the preparation of humus; the raw material ranges from the highly nitrogenous residues of the animal carcase to plant residues consisting of almost pure carbohydrate, cellulose and lignin. A second difficulty lies in the fact the conversion to humus is a biological reaction, the work fungi and bacteria. These, being themselves organisms, require for their vigorous growth and action that, the conditions shall lie within certain

broad limits particularly in regard to humidity, temperature, air supply and acidity of matrix. Further the process of preparation consists of a series of steppings-down, from one stage in the descending scale of organic complexity to a still lower stage, and each step is broadly speaking the work of some specific organism each with its own specific optimum environment to a greater or less, and in some cases greater than less extent differing from the optimum of the remaining organisms. In this respect the art of preparation consists very largely in bringing the natural environmental conditions into line with the optimum for the particular stage of the preparatory process. These difficulties may impart an ambiguity to any description of the method of manufacture which may further induce a condition similar to that of the centipede on being asked by the toad which leg moved after which. The process is not, however, so full of obstacles as that implies; all process involving fermentation are "tricky" and incapable of exact definition. That has not prevented them from being adopted on a large scale, and they form, in fact, the foundation of many large industries, such as brewing, the preparation of cacao, and the curing of tobacco. Here, as in these other cases, practice is far better than precept.

First. then as regards the raw materials ; the bulk of these in an agricultural setting consists of plant residues which for the most part are composed of carbohydrates of varying resistance to the action of the attacking organisms. These like all other organisms, require a certain supply of the essential plant foods. and in the case of the more resistant tissues there is usually a deficiency of nitrogen. To make up for this deficiency some nitrogenous substance should be added to give a carbon nitrogen ratio of approximately 33:1. Success will also depend on the mechancial state of the material. Woody tissues are protected by bark, which requires to be broken down so that the organisms of destruction may have ready access. Such woody material may be broken down on the farm roads where an adequate traffic of farm vehicles occurs.

The farm also supplies suitable nitrogenous material in the form of urine and the droppings of animals. The advantage of the use of these rests not only in their availability on most farms but on the fact that such natural products are found to contain a not readily definable something which gives to them a superiority over nitrogenous materials of inorganic origin. It is a something which acts apparently through the mycorrhizal association above referred to, for, apart from the obvious increased vigour and freedom from disease which characterizes plants grown on a natural humus, a study of the root system shows a strong development of mycorrhiza. Humus, it is true, whatever its origin, possesses a certain value as a supplier of plant food calculable in terms of N, P and K; but the value derived from this at present illdefined something transcends these more readily determined values. Chemical analysis, in fact fails as a yard measure of this latter value, and actual use may not improbably reverse the verdict of the laboratory. Until the nature of these elusive constituents of the animal residues is better understood, such residues will form a necessary raw material of an effective and sound system of agriculture.

With these two raw materials available it is now necessary to consider the conditions required if fermentation of the combined mass is to proceed along the lines which will yield the maximum of the desired product. As the fermentation proceeds, the mixture soon becomes acid, a condition inimical to the action of the micro-organisms it is desired to render most active. This acidity must be neutralized. Wood ashes, in that they supply additional potassium are very suitable for this purpose; but if these are not available calcium in the form of powdered chalk or limestone (but not quick-lime, which is too fierce) serves the purpose well and these bodies may be diluted with earth.

With these three materials to build up the matrix all the essentials for the preparation of humus are present. It now remains so to handle the mixture that the fermentative process proceeds along the lines which will result in the maximum yield of high quality product. For this purpose not only must the three constituents be sufficiently mixed for a uniform growth of the organisms concerned, but the environment must be adopted to suit their particular needs. Of the major factors of the environment, temperature may be omitted from consideration. As is well known a very considerable heat is developed in the course of the fermentative activity and this can be left to look after itself. What has to be regulated is the supply of air and moisture. The latter is required during the whole of the period of production: and abundant supply of air (the natural source of oxygen) is required only during the early stages. The reason for this is that the organisms responsible for these early stages, the decomposition of the more resistant carbohydrates, cellulose and lignin, are aerobic (operate only in the presence of ample supplies of oxygen). It is in these early stages that control is most difficult for a balance has to be struck between the amount of water and air occupying the interstitial spaces of the mass. The ideal that should be aimed at is a condition similar to that of a pressed-out sponge. In practice the tendency is in the direction of an excessive amount of water.

The need for an adequate air supply raises another point. The action of the organisms results in an absorption of the oxygen and the evolution of carbon dioxide. Unless, therefore, matters are so arranged that a sufficiently rapid interchange of gases can take place with more oxygen replacing the carbon dioxide as fast as this is formed the activity of the organisms will be slowed down. In practice it is found that adequate percolation of air into such a matrix as has been indicated proceeds only to a depth of some 18 to 24 inches.

One further point must be attended to. In whatever form of heap the matrix may be built, uniform conditions cannot be maintained throughout; the outer layers being more exposed to the air, will be subjected to more variable conditions of humidity, air supply and temperature. This has to be adjusted by intermittent turning of the heap so that the exposed material becomes buried.

The preliminary fermentation is primarily the decomposition of the non-nitrogenous carbohydrate residues and is mainly the function of aerobic fungi, for the activity of which the deficiency of nitrogen is made good by the addition of the nitrogenous substances. The decomposition of nirogenous residues is the work of anaerobic bacteria for which special measures for the aeration of the mass are not necessary.

These are the main principles underlying the successful production of compost; they must guide the practical steps, and the Indore process, now so widely adopted, is based on them and takes into consideration also the economic considerations which are of almost equal importance. In this the heap is conveniently 30 ft. long by 14 ft. wide, with the material piled to a depth of 3 ft. The pit is divided into six sections of which the second from one end is first charged, the end section being reserved for turning. The vegetable wastes are laid across the section to a depth of 6 in. and on this a layer of 2 in. of animal wastes, on which is sprinkled a mixture of urine-earth and wood ashes as a thin layer. The process is repeated till the maximum depth is reached. If the depth is greater than 2 ft. and it may be as great as 5 ft. vents must be made (conveniently done by working a crow-bar), say three to a section. The third and subsequent sections are then built in like manner. The amount of water to be sprinkled on each layer is at once the most important and difficult of the operations concerned as it will depend on the nature of the material; experience is here the best guide. Later regulation of the water supply, depending

as it does on the climatic conditions, is also a matter best learned from experience. A decision is here required whether the material should be heaped or pitted and after construction, whether additional watering should be given. If correctly charged the heap will show active fungus growth in three days, and in a few days the depth will decrease from 5 ft to 3 ft.

A first turn should be made after two to three weeks, and again, after some five weeks, in the reverse direction when the aerobic stage will be approximately complete. Opportunity can be taken at each of these to regulate the humidity of the heap. A guide to the efficiency of the process is given by the temperature, which should quickly reach approximately 150°F. and fall to some 85°F. after 90 days, with intermediate rises after the turn.

The first stage, which continues up to and shortly succeeding the second turn, is the preliminary aerobic stage, and it is followed by the anaerobic stage in which the active organisms are bacteria. It is during this stage that fixation of atmospheric nitrogen takes place, and the gain of nitrogen may be considerable, for if the process is efficiently conducted there is little loss of original nitrogen in the heap that is absorbed into the body of the agents of decomposition.

After some 90 days the process slows down and the relatively stable condition of the material, to which the name humus is applied, is reached. It is now ready for the land. But complete stability is never reached. Oxidation continues, nitrification will set in, and the nitrates formed may be lost by leaching, or if carelessly stored, de-nitrification may lead to the loss of the nitrogen which so many pains have been taken to secure. Immediate application to the land is the best safeguard against such losses; if this be impossible, it should be kept under cover and turned from time to time. It is an asset which it will pay to conserve.

It is a curious fact that while some of the tropical agricultural industries notably tea and sisal, are increasingly turning their attention to the preparation and use of compost, the reverse process is taking place in the sugar industry. In those countries the West Indies and Mauritius where a long established procedure based on pen manure existed, this material is giving way to the employment of artificials. The explanation lies largely in the economic sphere; the development of the tractor has rendered the head of cattle previously kept uneconomic when considered merely as a source of power. In those newer areas Cuba, Hawaii and so on, a virgin fertility has been fortified by artificials from the commencement. It may well be asked whether a stable industry based on what is, in practice a mono-culture, can be possible in the case of sugarcane alone among crops, if the precepts of nature are so lightly regarded.

The main factors which militate against a return to organic manures are the intractability of the major residues of the crop, cane trash and bagasse, particularly the former since a large proportion of the latter is consumed as fuel, and the supposedly inadequate supply of nitrogenous wastes consequent on the reduction of the stock carried. The problem of how these wastes can be economically converted into compost has yet to be seriously tackled. The general lines are clear. It is a general experience that mixed vegetable residues are more readily decomposed than a uniform residue such as trash and it may be found economic to grow a green crop for the purpose of admixture. The other factory wastes, filter press-cakes and molasses, with distillery wastes will also help in this direction as well as in supplying a mass of readily decomposable material. The nitrogenous activator if an adequate supply cannot be secured from the stock kept might well be looked for in any suitably installed sanitary

system for the labour lines which are usually a feature of sugar estates. The Indore process can be readily adapted for the handling of habitation wastes under hygienic conditions. A preliminary attack on the problem has been made in South Africa by Dymond, who has shown that trash requires to be weathered a little before composting, and by Tambe and Wad in India.

(*The International Sugar Journal* 42 (1940) : 341—343.)

ABSTRACT

Composts and Soil Fertility C. N. Acharya, *Indian Farming* : 1 (1940, 66-68). The importance of maintaining a satisfactory level of organic matter in the soil is now generally accepted by scientists and farmers alike. The maintenance of a high level of organic matter is far more difficult in the soil of the tropical and sub-tropical regions than in that of the temperate zones. Hence, if the fertility of the tropical or sub-tropical soil is to be maintained, the application of bulky organic manures almost every year becomes quite necessary. Farm yard manure, one of the most important organic manures, is of course in largest use in this country. While the average supply of farm yard manure is about a ton per acre, the average demand is about 5 to 10 tons per acre of land under cultivation. To make up the above deficiency, composts come in quite handy as a suitable and efficient substitute. The Chinese have been adepts in the method of composting since very ancient times. There is need to copy the Chinese example, and to utilize all our resources, if the productivity of our land is to be maintained, if not improved, in view of the ever-increasing population in our country. A great many methods have been recently suggested for composting waste organic materials. The 'Adco' process developed at Rothamsted, the Indore process developed by Howard and Wad and its subsequent modifications, the Madras method worked out at Coimbatore, the Activated Compost process evolved by Dr. G. J. Fowler, the Hot Fermentation process worked out at the Indian Institute of Science, Bangalore, are some of the most important. The essential features more or less common to all the above are the following:— (1) The basic material for composting is the bulky organic refuse, *e. g.* leaves, weeds, stubbles, stalks, husks, etc. (2) A suitable starter is added—organic nitrogenous substances, such as night-soil, urine, sewage, activated sludge, or inorganic nitrogenous compounds such as Adco, ammonium sulphate, sodium nitrate, calcium cyanamide, etc, which serve to promote the rapid development of the necessary micro-organisms, which effect the decomposition. The amount of the starter required for decomposition depends on the amount of nitrogen initially present in the refuse. The addition of phosphorus compounds to the " starter " in the form of rock phosphate, basic slag, bone meal or super phosphate, help to improve the quality of the manure though it does not ordinarily increase the rate of decomposition. Another function of the " starter " is to act as an inoculant carrying a vigorous micro-flora for decomposition. The addition of an inoculum, such as actively fermenting compost (used by Dr. Fowler in his Activated Compost method) dung, night soil or sewage, shortens the time of composting. (3) The maintenance of an optimum moisture level in the compost heap—usually 50% of the wet heap—with the reaction at the natural or slightly alkaline range is insisted on. In the Hot Fermentation method the loss of moisture by evaporation is prevented by covering the heap with earth and mud paste. (4) A proper physical condition or body in the compost heap is necessary to start with. Woody materials such as cotton stalks may be broken down under the feet of cattle or under the wheels of carts (5) The rise of temperature in the compost heap destroys weed seeds, fly maggots, worms and pathogenic organisms. The points of difference between the various methods of composting at present in use are the following :— (1) The majority of methods are " aerobic "

The intensely aerobic method of treating the ordinary mixed farm wastes may shorten the period of composting, but will lead to heavy losses of organic matter and nitrogen. It is found advantageous to stop the aerobic treatment after about a week, as in the Hot Fermentation process, and allow further decomposition to take place anaerobically. (2) The refuse decomposes more uniformly and results in a better quality of manure if made in pits or trenches than in heaps overground. (3) The degree of disintegration of the final manure varies in the different methods. The aerobic methods aim at carrying the process to a stage till the material becomes powdery involving heavy loss of organic matter and nitrogen and greater labour and watering charges. The Hot Fermentation method overcomes the disadvantages of the aerobic method. (4) If losses of nitrogen are to be avoided, the aerobic treatment has to be stopped at the proper stage, especially when mixed farm refuse containing dung and urine is used. The addition of inorganic nitrogenous compounds as 'starters' increases the loss of nitrogen. Intense aerobic treatment will be found advantageous if large amounts of refuse poor in nitrogen are to be composted. (5) A simple system like the Hot Fermentation method would suit the Indian ryot better than the aerobic systems requiring several turnings and waterings like Indore process. The beneficial effects of the application of organic matter to the soil can be classified under three heads:— (i) improvement of the physical condition of the soil, (ii) supply of plant nutrients and (iii) biological factors and supply of plant harmones. If the Indian ryot hopes to get a reasonable profit by application to his land, of the composts prepared by him, he must take into consideration the following factors, viz., the nature of his soil, the assuredness of enough water supply for irrigation purposes, the quality of his manure, the nature of the crop to which he is applying it and other points such as his ability to supplement the compost with small doses of inorganic fertilizers.

P. A. V.

The growth of the rice seedling (*O. sativa*, Columba variety No. 42) in salt solution of different H ion concentrations. R. E. Cooper and D. V. Sohonee. *Jou. Ind. Bot. Soc.* 19 (1940): 299–310. Dustur and John (1937) had previously established that the most favourable pH for the growth of rice seedlings is between 6·0 and 7·0 and that solutions of ammonium sulphate and ammonium phosphate produce better growth than potassium nitrate. They did not, however, employ culture solution of higher pH value than 7·0. The present authors grew seedlings in salt solutions varying in pH from 6·0 to 8·0 with a gradation of 0·2. The salts used were the sulphates of sodium, potassium, ammonium and magnesium; nitrates of sodium, potassium, ammonium, calcium and magnesium and phosphates of sodium, potassium and ammonium. Knop's and Tottingham's culture solutions were also used in addition to the above. The growth of the seedlings was estimated from their dry weights. The important conclusions arrived at from the investigation are as follows:— (1) The most favourable reaction for the growth of rice seedlings was found at pH 7·0 and 7·2 for all salts and culture solutions. (2) The maximum increase in dry weights amongst the nitrates was obtained in the ammonium nitrate and potassium nitrate solutions the two salts being equal in their effects. (3) The minimum increase in dry weight was obtained in the calcium nitrate solutions. (4) The maximum increase in weight was obtained in ammonium nitrate solution at pH 7·0, while in the potassium nitrate solution it was at pH 7·2. (5) The maximum increase in dry weight of the rice seedlings amongst the phosphates was obtained in ammonium phosphate and potassium phosphate solutions, both being equal in their effects. (6) The maximum increase in dry weights of the rice seedlings amongst the sulphates was obtained in the magnesium sulphate solution at pH. 7·2. (7) In general, phosphates were found superior to nitrates and sulphates,

as the greatest increase in dry weights occurred in the phosphate series. This is probably due to very small growth made by the seedlings in calcium and magnesium nitrate. If these two are not taken into account the nitrates of ammonium and potassium are superior to phosphates of the same two kations. But sodium phosphate on the other hand has given greater increase in dry weight than sodium nitrate. (8) There is a greater fall in dry weight in the nitrates than in the phosphates of different kations as the pH of the solution increases from pH 7 2 onwards. If the solutions of all the pH values are considered together, the average increase in the dry weights in the ammonium and potassium nitrate solutions are lower than in the phosphates of the same kations. Thus for the rice seedlings the range of favourable reaction is wider for the phosphates than for the nitrates. (9) The superiority of magnesium sulphate for the growth of the rice seedlings over the sulphates of the potassium and ammonium has been wholly unexpected and it is difficult to explain it at present. (10) The interaction of kations with pH was highly significant, indicating that the effect of each kation on growth was modified by the pH of the salt solution.

K. R.

Earthing up of Sugar-cane. Sethi R. L. *Indian Farming* 1 (1940): 166—169. Earthing up of canes is a common practice in many important tracts throughout India. It may either be done early in the season when the plants do not exhibit any internodes above ground or later during growth when plants are well above the ground level and have formed a few internodes. In Mysore, earthing has proved valuable in lessening the borer attack. There, earthing is done much earlier in the season when the plants are small and are susceptible to the borer attack and is different from the final earthing done later to give mechanical support. It is when the cane shoots are almost a foot in height (i. e., about the time when the crop is almost four weeks old) that the young larvae of the pest bore into the shoots at the base and by eating up the tissue cause "dead hearts". Earthing up the canes before the 'dead hearts' are formed keeps off the borer larvae from getting into the cane shoots and thus saves the crop from the attack of the pest. If the earthing up is done later i. e., when a fairly large number of "dead hearts" are visible, the fresh tillers appearing from the diseased shoots are saved from an attack of the pest as the larvae in the diseased shoots are enveloped by the soil heaped up at the base of the shoots by the earthing and thus prevented from moving on to the healthy shoots. Removal of "dead hearts" at this stage is not advocated, as by doing so the young caterpillars which would otherwise remain plugged in the dead cane shoots would find their way out to attack healthy shoots. The fall in the percentage of attack by borers as a result of this earthing and green manuring with sunnhemp is as below:—

Variety.	Normal.	Lessened after earthing and green manuring.
Batjan	70	9
POJ. 2878	55	8
POJ. 100	60	10
Co. 281	68	8

The results of experiments at Padegoan, however, are at variance with those obtained at other stations. These have indicated a definite tendency towards higher yields in crops grown in unearthed conditions. This is mainly ascribed to the presence of a large number of millable canes at harvest time in this treatment owing to the development of late tillers which are otherwise smothered by the operation of earthing.

Experiments in different centres have shown that earthing up at the later stages has the effect of improving the purity, increasing the sucrose contents at the time of harvest, though not earlier. M. A.

Report on the Marketing of Coffee in India. (*Issued by the Agricultural Marketing Adviser to the Government of India*). *Historical.* The original home of the coffee plant is believed to be Abyssinia from where it was first introduced into Arabia in the 5th century A. D. Introduction of coffee on a commercial scale to the rest of the World dates from the 16th century A. D. and it was in this century that it was introduced in India at the Baba Budan hills in Mysore.

Varieties. Coffee belongs to the genus "Caffea" under the natural order Rubiaceae, in which are included other economic plants like Cinchona and Ipecacuana. There are some fifty species and sub-species of coffee which are shrubs or trees under 30' in height. However, the economic types are *C. arabica*, *C. robusta* and *C. liberica*.

C. arabica is a king of the Coffee tribe. The plant flourishes on elevations between 2,500′—5,000′, grown under heavy shade. Yield varies from 100—1,200 lb. per acre.

C. robusta. The original home is Congo. It is a much larger plant than arabica, grows at elevations 1,000—2,000′ lower than those considered essential for the cultivation of arabica. It is a more prolific bearer, resistant to pests and diseases. Average yield 450 lb. to 675 lb per acre. Beans are small and round.

C. liberica is a native of tropical west Africa and is a larger and sturdier plant than arabica, but the quality of the beverage is inferior. It can be grown in hotter climates. It is vigorous in growth, disease-resistant and a bumper yielder. The bean is large with a pronounced flavour.

Climate and soil A temperate climate in a tropical zone is most suitable for coffee cultivation. Coffee grows best in well-drained soils, rich in humus, moist and friable. A mean annual temperature of 70°F with an average minimum of 55° and an average maximum of 80°F is generally suitable. Coffee cannot withstand frost. It grows at altitudes ranging from sea level to 5,000′. However an altitude of 2,500—5 000' with suitable soil and shade produces a very good quality of bean. The annual rainfall should be about 70″—evenly distributed.

Yield and longevity in coffee. Coffee begins to bear from the 3rd to 5th year. Coffee trees are generally in full bearing capacity between the age of 10 to 30 years. The life of a coffee plant depends mostly on the care and proper management of the estate. It is up to 80—90 years.

Area under different species of coffee in 1937—38 in India.

Arabica.	*Robusta.*	*Liberica.*
1 89,370 acres.	19,770 acres.	50 „

About 90 % of the area is under arabica and 10 % under robusta.

Average acreage and production in 1932—37 in India.

	Acreage.		*Production.*
Mysore.	50·2 %	...	45 3 %
Madras.	26·5 %	...	24 0 %
Coorg.	19·5 %	...	26·6 %
Travancore.	3 8 %	...	2·9 %
Cochin.	0·9 %	...	1·2 %
Other parts.	0·1 %	...	...

The area under coffee in 1936—1937 in the World was 12,768,000 acres.

Brazil.	...	8,555,000.	„
Colombia.	...	885,000	„
Haiti.	...	350,000	„
India.	...	190,000	„

Production in 1936—1937. The world production was 49,888,000 cwt.

Production in Brazil was		31,042,000 cwt.
"	Colombia	5,256,000 "
"	Haiti	488,000 "
"	India	304,000 "

Area under coffee in Madras, Coorg and Mysore.

	Madras.	*Coorg.*	*Mysore.*	*Total.*
1913—1914.	48,785	42,991	105,539	197 315
1933—1934.	52,009	40,586	103,206	195 801

The annual World export of coffee was about 30 million cwt. in 1930—1934. The U. S. A. takes about 50 % of the world imports or equivalent to 25 times the production of India. France is the next biggest consumer taking 3·6 million cwt. and Germany takes 3 million cwt.

Supply. The value of annual production of coffee in India is estimated to be 1½ crores of rupees and the plantations provide employment to nearly a lakh of persons.

The personal attention bestowed on smill plantations neutralises to a certain extent, the effects of primitive methods of cultivation. About 37,000 acres are under small plantations and the entire crop from these small plantations is 'cherry dried' which sells at a cheaper rate than 'parchment' (plantation) and hence the smaller producers suffer and fare worse than the bigger producers. It would be better if the small producers, pool their resources and put in the market, a fairly uniform and standard quality product. This is of importance in Madras, Travancore and Cochin where small holders are numerous.

The average yield per acre of *arabica* and *robusta* for the years 1932—36 was 217 and 453 lb. respectively. *Robusta* is becoming increasingly popular with small planters on account of its disease resistance qualities and prolific yield.

The percentage of 'plantation' and cherry' in the quinquennium ending 36—37 was 52 and 48 respectively. The production of 'cherry' is high in smll holdings as the preparation of coffee as 'parchment' depends on water facilities in the estate. Large number of estates in Mysore have no proper water facilities. It is clearly detrimental to the producer to prepare his entire coffee as 'cherry'. Better facilities for assembling, pulping, and water supply are urgently called for.

It would be in the interest of the growers to have all their coffee cured and properly graded. In 1935—1936, only a third of the total produce was cured. On the whole about 55% of the estimated production of 'parchment' (plantation) coffee and about 18% of 'cherry' passes through the curer. The percentage under different grades are as follows:—

A grade	...	52%
B grade	...	26%
C grade	...	5%
Peaberry	...	9%
Triage	...	8%

The harvesting period is normally from October to March. 'Parchment' (plantation) starts coming into the market earlier than 'cherry' and it begins from December. 'Cherry' is ready in January—February. The harvesting season in Brazil is found to be from the middle of March to middle of September and coincides with the off-season in India.

About 10,000 cwt. of chicory valued at about Rs. 1,30,000 are imported into India every year. About 60% of the imports are from Holland, 30% from Belgium and the remainder from United Kingdom and Germany.

India exports annually about 32% of her coffee valued at about 1 crore of rupees. The United Kingdom and France have been India's best customers and more than 50% of her exports are absorbed between them. India's leading position for quality coffee was almost unchallenged before the Great war, but competition has since been keen from Costa Rica, British East Africa and Colombia. Shipments to the United Kingdom, consists nearly of 90% A grade "Plantation" coffee and are usually concentrated in the months January—May, while those to France start from September and go on to June. Shipments to Norway are spread over all the months.

The net available market supply in India was about 435,340 cwt. in 1935—1936. The per-capita consumption in India for 1935—1936 may be reckoned at 0·137 lb.

Demand. About 96% of the coffee available for consumption in India is consumed within Madras, Coorg, Mysore, Travancore and Cochin, the rest of the country consuming only about 4%.

The per capita consumption in the non-producing areas is about 0·006 lb and in the producing areas about 0·7 lb. If the rate of consumption could be increased by even 0·15 lb. per head, the entire coffee produced in India could be easily absorbed in this country.

Ceylon and the poorest consuming areas in Europe like Hungary and Rumania take about 4 times the quantity that is consumed per head in India. In United Kingdom the consumption is 5 times more than in India. It is a matter of considerable significance, that although India produces some of the best quality coffees of the world, her consumption ranks so low as compared with other countries. The Indian coffee cess committee constituted by the Government of India in 1935 has, however, made a beginning with market propaganda to tap the potential internal demand.

On an average 340,000 cwt. of *arabica* as against 50,000 to 60,000 cwt. of *robusta* are consumed every year the demand for the former being mostly from the producing areas. Coffee consumed in India is sold in the following form.

Raw beans	...	90%
Freshly ground	...	6%
In tins & tablets	...	4%

Figures of consumption for 1933—34 and 1937—1938 show that except in Bombay, United provinces, Punjab, North-West Frontier and Delhi, there is an appreciable increase in consumption of coffee in all other areas of North India are slowly taking to coffee. Well directed propaganda should speed up this process. In Madras and Mysore, the coffee drinking habit is spreading from urban to rural population and from the upper to middle class.

The United Kingdom imports only quality coffee from India, but the continental countries mostly take "cherry" and "monsooned" coffee.

The Ottawa preference came into force in 1933 and while the share of imports from India rose from 7·5% in the quinquennium ending 1933 to 9·7% in the following quinquennium, the share of Empire countries rose from 43 to 47% and E. Africa fell from 38 to 35·9 %.

Ceylon imports cheap *robusta* coffee mostly from Java and the possibility of introducing Indian *robusta* as against Java *robusta* into Ceylon should be explored, particularly when India has lost the Ceylon market—her exports to Ceylon having fallen from 13,400 cwt. to 200 cwt. a year.

Prices. Coffee has a larger range of quality than many other agricultural products. The quality varies in the same type, variety, and season from district to district and from plantation to plantation.

Brazil holds the key to world prices. The world price of coffee and the demand in South India are the chief factors that influence the course of prices of Indian coffee. Statistics reveal that the price of coffee is below the average prices of 1931 unlike that of tea and tobacco. This is a significant and serious problem facing coffee producers in the country.

Prices are generally above the average in January and below the average from April to December.

The market information available at present for the planters and the trade is very scanty. The Curers' Association in Mangalore is the only organised body which issues weekly bulletins for its clients. The Indian coffee cess committee at Bangalore started in 1938 is issuing a monthly bulletin, containing a review of world position and summary of market reports of a few important centres.

Arrangements to broadcast from Madras and Trichinopoly, a brief resume of the salient feature of the market, on fixed days, would be useful.

Preparation for the Market. The quality of coffee depends to a considerable extent on the method of preparation of the produce. Even the best crop can be spoiled by crude methods of preparation.

The two methods in India are the "dry" (native) method and the "wet" (washed) method. Coffee prepared by the former method is known as "Cherry" or "Native" and that by the "Wet" method as "Plantation" (or Parchment). In the case of cherry preparation, the berries are stripped from the branches, ripe, over-ripe, and green altogether, whereas for "plantation" (Parchment) only fully ripe berries are picked. The smaller plantations usually prepare the produce by the dry method.

Detailed information given on pulping, curing, drying, peeling, grading, garbling and monsooning are worth reading. K. S. S.

Agricultural Jottings.

TRANSPORT FACILITIES FOR FRESH FISH FROM THE WEST COAST TO THE MADRAS MARKET

The fishing season in the West Coast usually lasts from September to April. Practically all the stations in the West Coast like Tirur, Tanur, Badagara, Calicut, Pantalayini and Parappanangadi export fish, and the quantity of wet fish sent to Madras City alone amounts annually to about 20,000 Railway maunds. Marketing as wet fish is more profitable to the fishermen as compared to cured fish. At present a lot of fresh fish is cured for want of facilities to market as fresh fish.

With a view to provide better facilities for traffic in fresh fish, the marketing staff arranged this season, through the kindness of the South Indian Railway, to run an insulated van as an experimental measure for the transport of fresh fish from the West Coast to Madras city. In order to demonstrate to the trade the advantages of the insulated van, comparative tests were made during September and October 1940, using the ordinary van as the control. The object was to find out whether in the insulated van there was (1) improvement in condition of fish and (2) saving in the quantity of ice used for packing as compared to transport by the ordinary van.

Although due to disturbed weather conditions, the catches were very poor this season, it was possible to arrive at some indicative results. Usually about 10 lb. of ice is used for packing one case of fish like the shark weighing in all about one Railway maund. In this case, the loss of ice in the insulated van ranged from 15 to 20% as against 80 to 100% in the ordinary van. In the case of small and more perishable types of fish, as pomfret, prawns etc., much larger quantities of ice as 30 to 40 lb. are used per case. The loss of ice in such cases ranged from 35 to 70% in the insulated van as against 40 to 80% in the control. It would appear therefore that a saving of ice by use of the insulated van can be effected, the exact quantity depending on the type of fish.

Apart from the saving of ice, the condition of fish transported in the insulated van was found distinctly better on arrival at Madras. The fish in this case was quite fresh and turgid, while in the non-insulated van, it was dry and about to go bad. The trade in Madras expressed satisfaction at the better condition of fish transported in the insulated van, and some reported better prices. These considerations should serve as an inducement to fishermen and exporting merchants to utilise the insulated van with advantage. The South Indian Railway has agreed to charge the same rate as that obtaining now for transport of fresh fish by the ordinary van.

The Marketing Staff have met fishermen on the West Coast and have arranged to establish business connections between them and the merchants in Madras city. Efforts are also being made through reliable businessmen in Madras to arrange for auction sale of fresh fish at different centres in the Madras city. To relieve the small exporter of the difficulty in having to pay railway freights in advance and thus enable him to book large quantities of fresh fish, arrangements are afoot to advance the amount at the despatching stations by the local bankers of the importing merchants at Madras.

As has been pointed out already, there is considerable saving in the amounts of ice required for packing fish when transported in the insulated van. It has been found that when the van was fully loaded the temperature showed a fall so low as 20°F. It is therefore necesssary that exports should be made in large quantities, in order to derive the fullest benefits from the insulated van. Due to poor catches this season and low supplies, the running of the van could not be continued longer. Whenever the catches are satisfactory, it is up to the trade to see that the fullest use is made of the facilities offered by the insulated van. The van can also be used advantageously for the transport of fruits, vegetables, etc.

Crop and Trade Reports.

Cotton—1940-41—Fourth forecast report. The average of the areas under cotton in the Madras Province during the five years ending 1938-39 has represented 9·7 per cect of the total area under cotton in India.

The area under cotton up to the 25th January 1941 is estimated at 2,320,600 acres. When compared with the area of 2 102,900 acres estimated for the corresponding period of last year, it reveals an increase of 10·4 per cent. 446,300 acres have been reported as sown since the last December forecast was issued. This extent comprises chiefly 265,600 acres under Tinnevellies including Karunganni in Coimbatore, 75,000 acres under Cambodia, 54 000 acres under Westerns, 33,000 acres under white and red Northerns, 16,300 acres under Warangal and Cocanadas, 1,400 acres under Salems and 1,000 acres under other varieties. The area sown in December and January is greater than that sown in the corresponding period of the previous year by 123,700 acres or by 38·3 per cent.

The increase in area in the current year as compared with the area in 1939-40 occurs in all the important cotton growing districts of the Province outside Kurnool, Nellore, Ramad and Tinnevelly. The variations are marked in Guntur (+23,900 acres), Coimbatore (plus 89,700 acres), Madura (plus 29,700 acres), Ramnad (minus 43,300 acres) and Tinnevelly (minus 42,400 acres). The area estimated in respect of Coimbatore is the highest reported in recent years while the area estimated in respect of Nellore is the lowest reported in recent years. The area under irrigated cotton, mainly Cambodia, is estimated at 280,900 acres as against 180,900 acres for the corresponding period of the previous year, an increase of 55·3 per cent.

Pickings of the *mungari* or early sown cotton crop in the Deccan have concluded. The yield was slightly below normal due to untimely rains. The crop was affected to some extent by the heavy rains of November in the districts of Nellore, Coimbatore, Ramnad and Tinnevelly and by the attack of insects in Kistna, Coimbatore and Tinnevelly. Normal yields are reported from all the districts except Kistna, Kurnool, Anantapur, Cuddapah, Nellore. Coimbatore, Ramnad and Tinnevelly (un-irrigated cotton only) where the yield is reported to be below normal.

The seasonal factor for the Province as a whole works out to 96 per cent of the average as against 97 per cent of the previous year. On this basis, the total yield is estimated at 513,200 bales of 400 lb. lint as against 435,400 bales for the corresponding period of the previous year. It is, however, too early to estimate the yield with accuracy as the harvest has not yet commenced in the major portion of the area and much will depend upon the future weather conditions and the toll taken by insect pests.

The estimated area and yield under the several varieties are given below:—

Area in hundreds of acres, i. e., 00 being omitted ; Yield in hundreds of bales of 400 lb. lint, i. e., 00 being omitted.

Variety.	Area from 1st April to 25th January.		Corresponding Yield.	
	1940-41. Acs.	1939-40. Acs.	1940-41. Bales.	1939-40. Bales.
Irrigated Cambodia	2,639	1,684	1,591	1,034
Dry Cambodia	2,384	1,828	499	378
Total, Cambodia	5,023	3,512	2,090	1,412
Uppam in the Central districts.	172	258	27	41
Nadam and Bourbon	263	201	12	10
Total, Salems	435	459	39	51
Tinnevellies *	6,483	6,438	1,550	1,499
White and red Northerns	1,830	1,930	217	241
Westerns	8,160	7,600	1,004	951
Warangal and Cocanadas	1,190	1,017	221	191
Chinnapati (short staple)	85	73	11	9
	23,206	21,029	5,132	4,354

* Includes Karunganni cotton grown in the Coimbatore District and Uppam, Karunganni and mixed country cotton grown in the South.

The average wholesale price of cotton lint per imperial maund of 82 2/7 lb. equivalent to 3,200 tolas as reported from important markets on 3rd February 1941 was about Rs. 13—3—0 for Cocanadas, Rs. 16—12—0 for white Northerns, Rs. 16—7—0 for red Northerns, Rs. 17—9—0 for Westerns (*Hingari* crop),

Rs. 13—2—0 for Westerns *(Mungari* crop), Rs. 28—13—0 for Coimbatore Cambodia Rs. 27 per Coimbatore Karunganni, Rs. 25—2—0 for Tinnevelly Karunganni, Rs. 25—1—0 for Tinnevellies and Rs. 20—12—0 for Nadam cotton. When compared with the price published in the last report i. e., those which prevailed on 7th January 1941, these prices reveal a rise of about 20 per cent in the case of Tinnevellies, four per cent in the case of Tinnevelly Karunganni and two per cent in the case of Westerns *(Mungari* crop) and a fall of about six per cent in the case of Cocanadas and Coimbatore Cambodia, five per cent in the case of Nadam, two per cent in the case of Coimbatore Karunganni and one per cent in the case of Westerns *(Hingari* crop), the prices remaining stationary in the in the case of white and red Northerns.

(From the Director of Industries and Commerce, Madras).

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 7th March 1941 amounted to 31,918 bales of 400 lb. lint as against an estimate of 410,400 bales of the total crop of 1940-41. The receipts in the corresponding period of the previous year were 17,157 bales. 47,224 bales mainly of pressed cotton were received at spinning mills and 3,185 bales were exported by sea while 31,784 bales were imported by sea mainly from Karachi.

(From Director of Agriculture, Madras).

Correspondence.

Rotation and mixed crops with Sorghum.

To

The Editor, The Madras Agricultural Journal.

Sir,

With reference to the interesting contribution on "Rotation and mixed crops with sorghum" pubilshed in the February 1941 issue of the *Journal*, I shall be grateful, if you can publish the following observations of mine.

I. Rotation of Sorghum with other Corps. In Guntur district, sorghum is an important crop not only by itself but also in rotation with commercial crops like tobacco, chilli and groundnut. As regards tobacco, both the Virginia cigarette type and the Country or *natu* types are grown to a large extent on the black cotton soils in the district under rainfed conditions. The reactions of the two types of tobacco to sorghum in rotation are different. In both the cases, sorghum is grown in the preceding *Pyru* or cold weather season from October to March and the land is fallowed with frequent interculturing till the next October when the tobacco, is planted.

Virginia tobacco following a crop of sorghum under these circumstances has been found to be earlier for harvest than after crops of maize or *variga* (*Panicum miliaceum*). The leaves at the time of harvest attain the desired greenish yellow colour earlier in the case of sorghum than with the other two cereals. The rate of maturity of leaves on the tobacco plant is found quicker and the quality of the flue-cured leaf is noted to be better with a preceding crop of sorghum than with the others.

But in the case of country or *natu* tobacco, a preceding crop of sorghum has been responsible for a thin-bodied leaf with less of oily, gummy, and resinous substances which are necessary for good quality *natu* tobacco. After a crop of *variga* the *natu* yields very good quality tobacco.

Tobacco is a very sensitive plant and is even said to be a good indicator of the soil conditions. In the case of Virginia tobacco, the early and quicker ripening nature of the crop might be due to (1) low nitrogen (2) high phosphoric acid and potash or (3) a low N/P_2O_5 ratio in the soil resulting from growing of sorghum. Though almost equal dry matter yields of sorghum and maize are obtained, it is quite possible that sorghum reduces the level of nitrogen more than those of phosphoric acid and potash in the soil, while maize may do just the reverse. This explains also the fact of poor quality *natu* leaf resulting from low levels of nitrogen after a crop of sorghum, Usually heavy bodied *natu* leaf is obtained by heavier doses of nitrogen. It is thereby indicated that sorghum in the *pyru* season in Guntur district is a heavier feeder of nitrogen than maize.

Chillies are also grown unirrigated in the black cotton soils of the district. Generally more fertile fields are planted with this crop. It is grown either without rotation or is closely rotated with *variga.* Chilli and *variga* require highly fertile lands. But if by any chance sorghum is grown on the land, the succeeding chilli crop yields shyly; the fruits are of a paler colour and of poorer pungency. This experience also helps to confirm that sorghum might be a heavier and quicker feeder of soil nitrogen, lighter and slower feeder of phosphoric acid and potash than maize and *variga* in the *pyru* season.

II. Effect of Leguminous Crops on the Succeeding Money Crops. Bearing in mind the recorded conclusions of the Cotten Breeding Station, Coimbatore namely, "The after effects of growing leguminous crops on cotton are not alike. Cluster beans have been found most beneficial in the case of irrigated *cholam,** while lablab and cowpea seem to do good to rainfed *cholam.* Soybeans, greengram, and cowpea do more harm than good when they precede Cambodia cotton in summer. *Pillipesara* (*Phaseolus trilobatus*) likewise depresses the yield of Karunganni cotton that follows it.", it is hoped the following observations will be of interest in this connection.

When the leguminous crops immediately precede cotton or tobacco and when the land has very little rest between the two crops, low yields are usually to be expected for the following reasons.

The available nitrogen might have been very much exhausted by the preceding pulse crop. The money crop of tobacco will then have a poor start, which results, to a large extent, in poor yields.

The fixed nitrogen left behind by the pulse crop might gradually become available after considerable fermentation of the organic matter, probably at a time when the vegetative phase of the crop has passed, and also at a time when the soil moisture gets reduced to such a critical level to be of no use to fresh reinforcements of plant food.

The leaves, usually shed from the leguminous crops, and the root residues might utilise a large amount of soil moisture for their fermentation and conversion into soil humus; and thus the resulting low level of soil moisture might limit production.

These points are illustrated in an experiment conducted to study the effect of three cereals and one legume,—1. sorghum 2. maize, 3. *sajja* (*Pennisetum typhoideum*), 4. groundnut. In June, all the four crops are sown each on about 25 cents in one field of black cotton soil (Guntur Dt.) and they are harvested by the end of September. Immediately afterwards, the land is ploughed harrowed and is divided across into three portions. One portion is manured with farmyard manure at 5 tons per acre; to another portion is applied a mineral mixed with 20 lb. N, 60 lb. P_2O_5, and 75 lb. K_2O per acre and the third portion is unmanured. Virginia tobacco is planted in the middle of October in the field.

* Sorghum.

Against expectations, the tobacco crop after groundnut is found to be very slow-growing as compared to that after cereals. Among the cereals, the tobacco crop after *sajja* is the best, followed by those after sorghum and maize respectively. Similarly in each preceding crop area, in the portion receiving the mineral mixture, the tobacco crop is found to start off well, while the growth of the tobacco crop on the farmyard manure strip is slightly larger than that in the unmanured plot.

In particular reference to the groundnut crop, the tobacco crop on the area that is not manured is slow-growing and poor, probably because the available plant foods are at a low level. The crop on the area receiving farm yard manure is slow to grow as the soil moisture might have been utilised for the germination of previous crop residues and for the reordering of the farm yard manure applied. The reaction to these fertilising sources is in evidence only too late during the decline of the soil moisture. On the area that received the mineral manure, the tobacco is seen to start off well and yield a good crop both in quantity and quality.

In the above observations are contained some very instructive lessons of Nature about the rotational value of sorghum and groundnut in the economy of commercial crops. The rotational value of a preceding crop on the quickness of start, the yield, and the quality of the succeeding crop remains to be determined for almost all the commercial crops. In order to give a 'good fit' for the money crops, this study is particularly of immediate importance in the unirrigated areas, for a 'misfit' cannot be so easily rectified as in the case of irrigated areas by irrigation and top dressing of chemical fertilisers. Much more urgent is the study in the case of millets and fodder crops, the main stay of the poor. Not only is it required in the interest of the ryot, but it is equally essential to the State, if only the soil is reckoned as the State Bank.

Based upon this consideration, the U. S. A. has launched detailed Soil Conservation Projects, in which the State encourages, not only by propaganda but also by monetary remuneration, the adoption of approved methods of conserving soil fertility, preventing soil erosion and building up soil reserves. In view of the age-long depletion of the soils in India, Soil Conservation Service should be organised in every Department of Agriculture at the earliest opportunity.

Old Secretariat, Delhi, March 7, 1941 — Yours etc., C. V. Saravayya Chetty.

Mofussil News and Notes.

Chidambaram. An agricultural exhibition was held during the local *Arudra Dharsanam* festival at Chidambaram from the 6th to 12th January 1941. It attracted more than 8000 to 10,000 visitors from the rural areas of the neighbouring taluks. Paddy and rice samples of the important strains of Aduturai, Palur and Coimbatore Agricultural Research stations, groundnut, gingelly and castor selections from Tindivanam station, graft and budded citrus and mango plants from Kodur Fruit Research station, were exbibited. Sugarcane varieties, fodder grasses and plantain varieties from Palur and Aduturai were on view. Improved implements for tillage and interculture, cream jaggery and malt samples appliances and chemicals used in the control of pests and diseases were also among the exhibits. Illustrated Tamil posters detailing all the improvements advocated by the Department were a feature. Two lantern lectures and several ordinary lectures were delivered to the interested ryots by he local Agricultural Demonstrator and the plant pathological Demonstrator of the division.

M. A.

College News & Notes

Students' Corner. *Students' Club Day.* The Thirty-second Annual Club Day was celebrated on 22nd February 1941 with great interest and enthusiasm. It was a day of merriment and unbounded happiness for one and all the students. The happy function commenced with 'Tea' at 4 p. m. in which about one hundred guests and all the students participated. The fancy dress competition evoked great merriment among the large gathering. After 'Tea' the guests and the students adjourned to the taste-fully decorated Freeman Hall where a meeting was held with A. R. C, Westlake Esq , District Collector, Coimbatore, in the chair. After reading of the reports of the literary and games sections for the year 1940—41, by the respective secretaries, prizes were distributed by the president to the winners of the several competitions. This was followed by a variety entertainment which included the following interesting items.

(1) Opening song by M. Ramalingam (2) The 'College rag' (3) The irony of a nick name—a farce in Telugu (4) Black Magic (5) 'To be or not to be'—a farce in English (6) The 'Village School Master' (7) 'From the frying pan to the fire'—a farce in Tamil and (8) Snake charmer. The 'College rag' provided great amusement to the large gathering. The pleasant function terminated with the presidential address followed by a vote of thanks to the Chairman proposed by Rao Bahadur G. N. Rangaswami Ayyangar, Principal of the College.

Cecil Wood Tennis Cup. In the finals of the annual singles tournament for the Cecil Wood cup, M. Hegde of the final year B. Sc. Class came out victorious defeating D. Narasimhamurthy. M. Hegde was also awarded the college 'colours' in Tennis.

Farewell Tea. A 'Social' to bid farewell to the out-going students of the final year class and the short course in Agriculture was arranged on 17—3—41 by the first and second year classes in the Freeman Hall. After 'tea' and music, speeches were made on behalf of tutors, coaches, and lecturers bidding farewell to the out-going students. The representatives of classes I and II next spoke in appreciative terms of the help, cooperation and guidance which they had had from the final year students. The representatives of the third year class and the short course made suitable replies. With the Principal's speech giving advice and wishing the outgoing classes all success and prosperity in their life, the function terminated.

Madras Agricultural Students' Union. A general body meeting of the resident and student members of the Union was held on 6th March 1941 with Rao Bahadur G. N. Rangaswami Ayyangar, President of the Union, in the chair, to consider the letter from Sri. N. Balakrishnan (an ex-student) setting forth the grievances of the unemployed agricultural graduates. The letter and memorandum which Mr. Balakrishnan submitted to the Director of Agriculture were read before the house. The letter pointedly drew attention to G. O. No. 1655 Public Services dated 3rd September 1940 which excluded the B. Sc. (Ag) degree as the qualification for employment in the Provincial and subordinates services in all departments except agriculture and (2) for admission into Madras University diploma course in cooperation.

The President explained at length what he had done for furthering the cause of the unemployed graduates of the college before and after the receipt of the letter from Mr. N. Balakrishnan. He said that possibly the Director of

Agriculture had already addressed the Government regarding the employment of agricultural graduates in departments other than Agriculture, and that it would be premature to take further steps till the decision of the Government is known. After some discussion in which senior members like Rao Bahadur V. Ramanatha Ayyar, Mr. K. Unnikrishna Menon and Mr. K. M. Thomas took part, the members resolved upon the following:

1. To wait on deputation (after obtaining the previous permission of the Director of Agriculture) upon the heads of departments such as Co-operation, Registration, Revenue, Education and Panchayats with a view to convince them of the special aptitude of the B. Sc. (Ag.) degree holders for service in their departments.

2. To entrust the working committee of the Union with the arrangements for the deputation with powers to form sub-committees and also to co-opt suitable members.

3. To make specific requests to the Registrar of Co-operative Societies, and the University of Madras to consider the case of the B. Sc. (Ag.) for admission into diploma course in Cooperation.

In connection with the financial assistance to the *Madras Agricultural Journal* the following resolution proposed by Mr. K. M. Thomas was passed unanimously.

"This General body meeting of the Madras Agricultural Students' Union authorises the president of the Union to address the Government of Madras, praying that a subvention of Rs. 600 be granted to the Union for enlarging the scope and increasing the utility of the *Madras Agricultural Journal* as a medium of educative propaganda in agricultural matters pertaining to the province."

The meeting terminated with a vote of thanks to the chair proposed by the Vice-president Sri. C. R. Srinivasa Ayyangar.

Academic Council. Sri. T. S. Ramakrishnan, M. A. of the Mycological Section was elected as a member of the Madras University Academic Council to represent the teaching staff of the college in the seat vacated by Sri. S. N. Chandrasekahara Ayyar.

Estate Committee. Sri. T. R. Naganatha Ayyar was elected unopposed as a member of the Agricultural College Estate Committee in the place of Sri. K. Sanjiva Shetty whose term expires by 31st March 1941.

Officers' Club. The following office bearers for the year 1941 were elected; President: Sri. H. Shiva Rao; Vice-president: Sri. S. Ramaswami Raju; Secretary: Sri. C. Balasubramaniam; Treasurer: Sri. S. V. Parthasarathy. Committee members: Sri. P. Krishna Rao, Sri. V. Gomathinayagam Pillai, and Sri. C. V. Nagaraja Rao.

Fieldmen's Association. At the general body meeting held on 10—3—41 the following office bearers for the year 1941—42 were elected. President: Sri. A. Raju Pillai; Secretary: Sri. C. S Narayanaswami Ayyar; Asst. Secretary and Treasurer: Sri. V. Mahadevan; Committee members: Sri. D. Devasirvatham Pillai. Sri. C. R. Venkataraman, Sri. V. Narayana Ayyar, and Sri. B. Rangaiah Pillai.

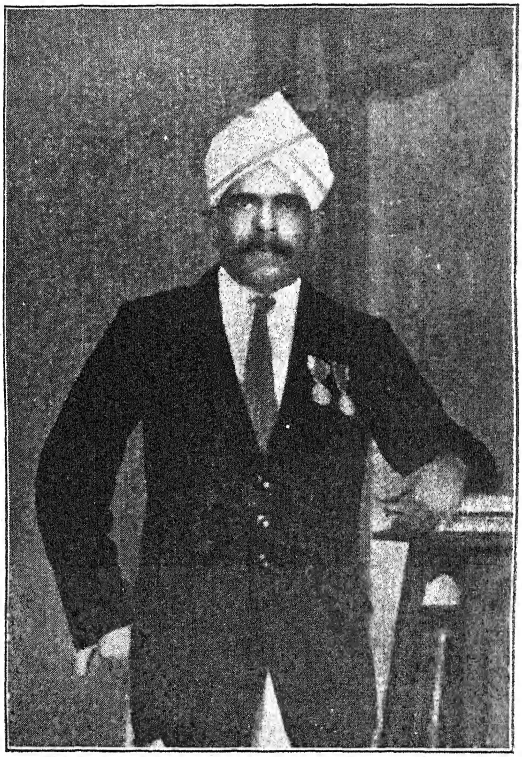
Personal. We are glad to learn that Rao Bahadur M. R. Ramaswami Sivan Retired Principal of the Coimbatore Agricultural College has been appointed Director of the Agricultural Institute, Anand (Gujarat). The choice of Mr. Sivan for this post is a fitting testimony to the active interest he has displayed in matters of vital importance pertaining to agricultural problems both in Madras

and elsewhere. We offer our felicitations to the Rao Bahadur and wish him a long and useful career at Anand.

Kamala Nehru Hospital Fund. The Students of the Agricultural College, collected a sum of Rs. 117—8—0 towards Kamala Nehru Hospital Fund and forwarded it to the headquarters through the Manager of *The Hindu* Madras.

OBITUARY

We regret to record the demise of Mr. T. V. Narayana Rao, retired Farm Office manager of the Central Farm, Coimbatore. Born in 1870, Mr. Narayana Rao was one of the earliest products of the Saidapet Agricultural College. He passed out of the Agricultural College at the young age of 20 and joined service as a clerk in the office of his principal Mr. Kees. In this position his merits commanded attention and he was drafted on as a member of the teaching staff at the College of Agriculture. In the early days of agricultual education when specialisation was not so advanced as in the present day, Mr. Narayana Rao was entrusted with the teaching of a wide range of subjects like agriculture, agricultural engineering and veterinary science, though under less pompous names. Though it was not his good fortune to rise very high in his official career, he had the satisfaction that several generations of his students did adorn the highest ranks in the Agricultural department. Mr. Narayana Rao was very popular among all classes of people and his long career of 35 years in the department was characterised by his great devotion to duty, scrupulous honesty and spotlessly straight dealings. His photograph which hangs on the walls of the Farm office where he spent the closing years of his official position, is a lasting inspiration to several younger generations of Farm managers who have since worked in that office. Mr. Narayana Rao was a devoted member of the Madras Agricultural Students' Union and was the editor of the Journal in 1916. He passed away peacefully at the ripe age of 71 at the residence of his son Mr. Narasinga Rao. We convey our sympathies to the members of the bereaved family.



Rao Bahadur Sri K. T. Alwa.

RETIREMENT

Rao Bahadur K. T. Alwa.

Kodialbail Thimmappa Alwa was born in 1886 in a well-to-do Bunt family owning lands in an interior village of Mangalore taluk. Born and brought up in rural surroundings and in a community with hoary agricultural traditions, young Thimmappa showed very early aptitude for the age-long family profession, so that when he passed his Matriculation examination and started struggling with mathematical problems of the old F. A University course, his parents decided that he should take up a career in scientific agriculture at the newly instituted Agricultural College at Coimbatore. In 1908 the shy Bunt youth joined the first batch of students at the Agricultural College at a time when the building now housing the Research Institute was only nearing completion and lecture classes were held in odd places including an adjacent residential bungalow. Alwa showed early promise in a course of study best fitted for his early environment and took the L. Ag. diploma with distinction in Agriculture and winning the Robertson gold medal. Early in 1912 he was offered an appointment in the Madras Agricultural Department as Assistant Farm Manager, Palur Farm. The initial salary of the post in those early days of the department was far from attractive, but by his perseverence, stamina for hard work and dint of character young Alwa rose in the course of nine short years from the position of the in-experienced Assistant Farm Manager to an Assistant Director of Agriculture. During this period Mr. Alwa saw service as Assistant Farm Manager, Taliparamba; Teaching Assistant at Coimbatore; Agricultural Demonstrator, Mangalore; and Demonstrator on special duty for the enforcement of the Cotton Pest Act in Coimbatore District. Mr. Alwa once confided to the writer of this note that the two most trying periods in his official career were those in which he served as Teaching Assistant under that famous disciplinarian Cecil Wood when the misdeeds of the back-sliders in the strenuous practical classes evoked the unrelenting ire of the Principal, and the period of Pest Act duty when he had to muster all his ingenuity and tact to get a potentially paying money crop pulled out within a statutory date without enraging the shrewd, but none the less uncompromising Gounden ryots of the Coimbatore district. Young Alwa's success in these two capacities revealed to his departmental superiors those rare qualities of adaptability, resourcefulness and tact which he possessed and this recognition paved the way for a promotion to the much-coveted gazetted rank in the service. For a period of 16 years from 1920 to 1936 Mr. Alwa saw service in almost every part of the province either as Assistant Director or Deputy Director of Agriculture. During this period, he acted for about 14 months in the Indian Agricultural Service and was placed on special duty on two occasions; the first in 1920—21 for six months to write a course of studies for the newly started Agricultural Middle Schools in the province and the other in 1927—28 to

investigate cotton marketing conditions in the Ceded districts and to recommend ways and means of financing the cotton growers of this famine-visiting tract.

Simple in his habits, with a smile and a kind word for every one, honest and straight-forward in his dealings, Mr. Alwa won the confidence of his superiors and the respect of his subordinates. Devoted to his duty, loath to interference in other people's affairs, and above all, endowed with human sympathy and kind feelings for fellow-beings in all walks of life, Mr. Alwa proved a great success in his official contacts. As a propaganda officer, his motto was "one thing at a time and that done well". His name is associated with several propaganda activities of the Department such as, the introduction of new varieties of sugarcane and inproved processes of jaggery-making, the spread of paddy strains, the introduction and spread of green manures, the popularisation of cotton strains, the extension of fruit culture and the control of the black-headed caterpillar of coconuts and the *Mahali* disease of areca palms.

In 1936, Mr. Alwa was drafted on as Headquarters Deputy Director of Agriculture where he had the unique distinction of functioning as the right hand man of three successive Directors of Agriculture. He was the recipient of the Silver Jubilee and Coronation medals, but an apter recognition of his services came in 1941 when he was awarded the title of Rao Bahadur.

Mr. Alwa was one of the founder-members of the Madras Agricultural Students' Union inaugurated in 1911 and has ever remined a devoted member. Besides being the Joint-secretary in the first year of its inception he has held office in the Union as executive committee member, sub-editor of the journal and moffusil Vice-president. With his retirement from service, he has been unanimously elected as a Patron—an eloquent testimony to his long period of loyalty and devotion to an organisation in the creation of which he played an important role thirty years ago. The Union and its Journal wish the Rao Bahadur a long lease of happiness and peace in his retirement and trust that he will continue his connections with the former fields of his activities. (K. M. T.)

Weather Review—FEBRUARY 1941.

RAINFALL DATA

Division	Station.	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	−0·7	0·0
	Calingapatam	0·4	−0·1	0·4
	Vizagapatam	1·5	+0·6	1·5
	Anakapalli*	2·2	+1·0	2·2
	Samalkota*			
	Maruteru*	0·2	−0·8	0·2
	Cocanada	1·4	+1·1	1·4
	Masulipatam	0·1	−0·3	0·1
	Guntur*	0·0	−1·0	0·1
Ceded Dists.	Kurnool	0·0	−0·2	0·1
	Nandyal*	0·6	+0·3	0·6
	Hagari *	0·2	0·0	0·2
	Siruguppa*	2·1	+1·8	2·4
	Bellary	0·7	+0·5	0·7
	Anantapur	0·8	+0·5	0·8
	Rentachintala	0·5		0·5
	Cuddapah	0·5	+0·4	0 8
	Anantharaju-pet *	1·0	0 0	1·1
Carnatic	Nellore	0·2	+0·1	0·2
	Madras	0 1	−0·3	0·7
	Palur *	0·2	−0·4	2 7
	Tindivanam *	0·3	−0·6	1·3
	Cuddalore	1·0	+0·1	4·3
Central	Vellore	0·0	−0·3	0·5
	Gudiyattam*	0·1	0·0	0·6
	Salem	0 0	−0·3	0·1
	Coimbatore	0·0	−0·3	0·8
	Coimbatore A. C. & R. I.*	0·0	−0·5	1·4
	Trichinopoly	0·0	−0 6	0·2

Division	Station	Actual for month	Departure from normal @	Total since 1st Janaruy
South	Negapatam	2·1	+1·5	3·8
	Aduthurai *	0·5	+0·1	1·7
	Madura	0·0	−0·4	1·4
	Pamban	1·1	+0·4	6·0
	Koilpatti*	0·0	−0·8	1·7
	Palamkottah	0·0	−0·8	1·4
West Coast	Trivandrum	0·0	0·0	0·9
	Cochin	1·0	−0·8	1·7
	Calicut	0·0	−0·2	0·6
	Pattambi *	0·0	−0·5	0·0
	Taliparamba *	0·0	0·0	0·0
	Kasargode *	0·0	−0·3	0·0
	Nileshwar*	0·0	−0·2	0·2
	Mangalore	0·0	−0·1	0·0
Mysore and Coorg	Chitaldrug	0·1	0·0	0·2
	Bangalore	0·0	−0·2	0·2
	Mysore	0·0	−0·2	0·1
	Mercara	0·0	−0·2	0·0
Hills	Kodaikanal	0·3	−1·1	4·5
	Coonoor			
	Ootacamund *	0·0	−0·1	1·3
	Nanjanad *	0·0	−0·6	0·9

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated up to 1937 (published in Fort St. George Gazette).

Weather Report for the Agriculturl College and Research Institute Observatory.

Report No. 2/41.

Absolute maximum in shade.	...	93·8°F
Absolute minimum in shade.	...	55·5°F
Mean maximum in shade.	...	89 4°F
Departure from normal.	...	−1·1°F
Mean minimum in shade.	...	66 0°F
Departure from normal.	...	0·2°F
Total rainfall for the month.	...	Nil
Departure from normal.	...	−0·52
Heaviest fall in 24 hours.	...	Nil
Total number of rainy days.	...	Nil
Mean daily wind velocity.	...	1·53 m. p. h.
Departure from normal.	...	−1·22 ,,
Mean humidity at 8 hours.	...	68·8%
Departure from normal.	...	−3·1%

Summary. Dry weather prevailed throughout the month. The day temperatures were slightly below normal while the night temperatures were normal. The sky was moderately to heavily clouded. The movement of wind and relative humidity were below normal.

Weather review for February 1941. The weather was generally dry throughout the month excepting on the first three days and the seventh and eighth when a few showers were received. The rainfall was generally in defect in the West Coast, Mysore and the Hills and locally in other places.

The chief falls of rain reported were :

Negapatam	1·9 inches	(9th).
Vizagapatam	1·5 „	(2nd).
Cocanada	1·4 „	(2nd).
Pamban	1·1 „	(8th).

The temperatures were above normal in the northern parts of the country.

P. V. R. & R. S.

Departmental Notifications.

Gazette Services

Tranfers.

Name of officers.	From	To
Sri U. Vittal Rao,	Offg. Asst., D. A., Tellicherry	Asst. D. A., Pattukottai.
„ M. U. Vellodi.	Asst. D. A. (on leave)	Asst. D. A., Tellicherry.
„ R. N. K. Sundaram,	Asst. D. A., Bellary	Asst. D. A , Cuddapah.
„ P. Krishna Rao,	Temporary G. A. to the Principal, Agri. College, Coimbatore	Temporary Superintendent, D. F. S. Hagari.
„ C. Vijayaraghava Acharya,	Temporary Superintendent. D F. S., Hagari	Temporary G. A. to the Principal, Agri. College, Coimbatore.

Subordinate Services.

Transfers.

Name of officers.	From	To
Sri M. K. Gopalan,	A. D. (on leave)	A. D., Trivellore.
„ P. Narayana Nayar,	A. D., Coimbatore	F. M., A. R S., Taliparamba.
„ E. K. G. Nambiar,	F. M., A. R. S., Taliparamba	F. M., Central Farm, Coimbatore
„ K. C. Thomas,	A. D., Palladam	A. D., Coimbatore.
„ S. Rajaratnam Chetti,	F. M., Nanjanad	A. D., Palladam.
„ T. Gopalan Nayar,		A. D., Gingee sub-circle.
„ L. Sankarakumara Pillai.	A. D. (on leave)	A. D., Wallajah.
„ V. V. Rajagopalan,	A. D., Dharapuram	F. M., C. B. S., Coimbatore.

Leave.

Name of officers.	Period of leave.
Sri V. G. Venkatarama Rao, A. D., Palmanier,	L. a. p. for 30 days from 25—3—41.
„ A. Shanmugasundaram, A. D., Pattukottai,	L. a. p on m. c. for 30 days from 2—3—41.
„ K. Sitharama Iyer, F. M., Pattukottai,	L. a. p. on m. c. for 4 months from 23—1—41.
„ C. S. Krishnaswami, Assistant in Mycology, Coimbatore,	L. a. p. for 3 months from 1—4—41
„ A. Chidambaram Pillai, Secretary, South Arcot Groundnut Market Committee	L. a. p. for 3 months from 4—2—41.
„ P. Nagadhara Nayudu, under the Cotton Market Committee, Nandyal.	L. a. p for 2 months and 14 days from 17—2—14.

CONTENTS

The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

Vol. XXIX] APRIL 1941 [No. 4.

EDITORIAL

The Civil Services and Agricultural Progress. Addressing the Civil Services Association of Mysore Mr. T. G. Rama Ayyar, Director of Agriculture, Mysore, and a senior member of the Mysore Civil Service stated that as a result of four years' study of agricultural problems of the state, he was convinced that close co-operation and zealous support of the members of the civil services would definitely ensure the expansion of the state's agricultural production and the prosperity of the people. Coming as it does from one of the few civil servants in India who can speak at once from first-hand knowledge of agricultural conditions of the country and the vast opportunities that lie in the path of the great fraternity of civil servants, we welcome this bold statement as one of great significance. We feel sure that what is true of Mysore is equally true of other parts of India where more than seventy percent of the adult population live on the country's national industry—Agriculture. It is well known that while the departments of Agriculture in the Indian provinces and states are striving hard to the best of their abilities and to the limited extent of their resources to collect sufficient knowledge and to take such knowledge to the door of the cultivator, these efforts at their best have so far touched only the fringe of a colossal problem that awaits solution. It should be within the experience of several workers in the development departments that a kindly interest displayed by a revenue officer can so often produce marvellous results. A district Collector holding a *Jamabandi* camp and questioning the village officials of their knowledge of the contents of the latest edition of the *Villagers' Calendar* or on the progress of a particular pest or disease campaign has often achieved results incomparably disproportionate to the little time or labour expended on an activity outside the rule-of-thumb revenue procedure. It is a matter of gratification to us that civil servants engrossingly interesting themselves in the activities of sister departments do exist, but alas! they are so few and far between. We commend the ripe experience of Mr. Rama Ayyar to the members of the Civil Services in Madras and elsewhere and trust that his appeal for their zealous co-operation will not go in vain. A vast field lies open to them where "the harvest is plentiful, but the labourers are few".

A Welcome Reform. Though the Government of Madras were always alive to the urgent need for the dissemination of knowledge of scientific agriculture, financial considerations have thwarted the immediate employment of an agency adequate to the task. It is a matter of satisfaction to us that the objective has all along been kept in view by successive directors and the Government, and the much needed expansion is being accomplished in stages. About four years ago the cadre of demonstrators was strengthened in order to provide one demonstrator for each taluk. In keeping with this policy a storekeeper was appointed for each agricultural depot and this step not only enhanced the utility of the depots but also prevented the dissipation of the demonstrators' valuable time spent on office routine. As a natural sequel to the expansion, the need was felt for a greater number of supervising officers for more effective guidance and control of the propaganda staff. We are glad to note that Government have now passed orders sanctioning one District Agricultural Officer for each district. Though the latest stage of reform was made possible by the surrender of some existing posts of Deputy Directors and demonstrators, the effect of which it is hazardous to predict, we trust that the new scheme will be given a fair trial. Should the experience gained in the working of the new system demand the restoration of the retrenched posts, we feel no doubt that the Government would hasten to take suitable action.

A Scientist Honoured. A bold spirit of scientific adventure and extraordinary acumen should be the qualities of a botanist who spurns the orthodox systematic botanists' time-honoured concepts of generic affinities and defies the imperfectly known canons of genetic laws when he attempts and succeeds in making intergeneric crosses among widely separated genera like *Sacharum*, *Sorghum* and *Bambusa*. India has produced only few scientists of this calibre and one such in the field of Botany is Rao Bahadur T. S. Venkataraman C. I. E., whose epoch-making contributions to the prosperity of the Indian Sugar-cane Industry have earned for him a place among the outstanding devotees to the cause of Agricultural science in the world. It is gratifying that some measure of recognition has come from the Government of India and His Majesty's Government in the award of the title of Rao Bahadur, the conferment of a Companionship of the Indian Empire and the extension of his period of service by three years to continue his valuable researches. We are glad that at long last one of the less hide-bound of the Indian Universities has decided to honour this eminent scientist (and incidently to honour itself) by conferring on him the honorary degree of Doctor of Science. We congratulate the Andhra University on its wise choice and the Rao Bahadur on an honour very richly deserved.

A few important cultivated and wild leafy vegetables of South India.

By S. N. CHANDRASEKHARAN, M. A.,

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That vegetables have played a very important part in the past and continue to do so in modern dietetics and that they are a very necessary menu in the every day meal of each and every person has been admitted on all hands. Among vegetables, leafy vegetables should be given the first and foremost place as they rank very high in the present day dietetics. In the first place they are the sources of calcium in abundance. Of all the metals calcium is the most important one as it is very essential for the building up of bones and teeth. Deficiency of calcium in the diet has been responsible for a number of diseases. At the present day bad teeth are so common even among young people that one has to think well about the diet one should adopt to avoid this trouble. Very naturally therefore greens such as amaranth, cabbage, fenugreek, spinach etc. are advocated to one and all especially to young children and expectant and nursing mothers. In the second place leafy vegetables contain the pigment carotene which is said to fulfil the physiological function of Vitamin A in the body. The importance of vitamins is so well recognised that it need not be dealt with in this short note. In the third place, the leaves are the repositories of valuable food materials such as the various mineral salts, sugars, proteins, oils, fats, etc. and as such a few of leafy vegetables consumed every day go to make the diet complete, nutritious and wholesome. Dr. Aykroyd remarks ' in the East it will usually be found that the easiest and cheapest way of ensuring sufficiency of Vitamin A units is to increase intake of green leafy vegetables".* For example, 3 ounces (about 85 grammes) of amaranth leaves will supply more than 3,000 international units and cover adult requirements. The needs of children of school age, which may possibly exceed those of adults can be covered in the same way by a high intake of leafy vegetables. In the case of leafy vegetables, a good rough indication of carotene content is their greenness. The greener they are the better and they are best in the fresh condition. Ordinary cooking does not destroy the carotene present in leafy vegetables. Intake of green leafy vegetables should be not less than 4 ounces per head per day. The cheaper varieties—amaranth leaves, coriander, drumstick leaves, etc. are as nutritious as the more expensive ones such as lettuce. In children's homes the available supply of green leafy vegetables could often be increased by creating a vegetable garden to be tended by the children themselves.**

* Aykroyd, W. R. (1938) *The nutritive value of Indian foods and the planning of satisfactory diets.* Health Bulletin No. 23. Manager of Publications, Delhi.

** *Ibid.*

In India we have a great many of these plants in use in different parts of the country. It was therefore felt that at least some of the commonest ones should be brought together and given a wider publicity than they are now receiving at the hands of the educated public. The plants are arranged in alphabetical order with a short note for each touching on the salient characters, the family to which the plant belongs and the popular name by which it is known (an index of the popular names is also given). Care has been taken to steer clear of the druggists' domain and confine oneself strictly to the sphere of the vegetable consumer. The distribution of the plants is given only for the Presidency of Madras.

1. *Abutilon indicum*, G. Don. Fam. Malvaceae, Eng. The country mallow; Tam, Tutti; Tel, Tuthru benda, Adavibenda.

An erect woody herb, 3-5 feet high, commonly met with in all waste places and in all districts especially in the hills. The stem is covered with smooth close tomentum. Leaves ovate, cordate, stipulate. Flowers yellow and showy opening in the evenings. The tender leaves are used as a 'pot' herb. Propagated from seed.

2. *Acalypha indica* Linn. Fam. Euphorbicaceae. Tam. and Mal. Kuppaimeni; Tel. Muripindaku, kuppinta chettu.

An erect herbaceous plant, about 2 feet high, growing wild in all waste places. Leaves simple, alternate, ovate. Flowers minute green, unisexual, monoecious. Leaves are cooked as a 'pot' herb and have laxative properties also. Propagated from seed.

3. *Achyranthes aspera* Linn. Fam. Amarantaceae. Tam. Nayuruvi.

A very common and very extensively growing weed in waste places. The plant is an erect small herb with a deep tap root. Branches minutely hairy, Leaves obovate up to 4" long. Flowers in terminal spikes. The leaves are used as a 'pot' herb especially by the poorer classes. Propagated from seed.

4. *Alternanthera triandra* Lam. Fam. Amarantaceae. Tam. Ponnangani.

A prostrate herb rooting at the nodes, grows wild in moist places all over the province. Stem glabrous, leaves obtuse or acute, up to 2" long. Flowers white in small heads in the axils of leaves. The leaves are very highly valued as a 'pot' herb. It is reported to be rich in iron. Propagated from seed.

5. *Amaranthus gangeticus* L. Fam. Amarantaceae. Tam. Thandu Kirai. Tel: Mokka Thotakura.

A very common, tall, leafy herb, both wild and cultivated. Practically every house which has a small kitchen garden grows this plant. Leaves large but variable up to 5" long and 3" broad. Flowers clustered in lower axils, gradually joined in a long terminal spiciform panicle. Flowers are green unisexual and polygamous.

The leaves and the young stem are cooked and consumed. A very highly valued 'pot' herb. Propagated from seed.

6. *Amaranthus gangeticus* var. *tristes* Pr. Fam. Amarantaceae. Tam. Araikirai. Tel: Koyya Thotakura.

The plant is a herb branching densely at the base and most widely cultivated throughout the presidency. It is a favourite with the people of the Coimbatore, Tanjore, Trichy, Malabar and Tinnevelly districts. The young branches are frequently cut several times a year. It is also the cheapest of vegetables. It is reported to be rich in iron and other nutrients. Propagated from seed.

7. *Amaranthus paniculatus* L. Fam. Amarantaceae. Tam. Pungi kirai.

The plant is a tall annual herb both wild and cultivated. Very much like the other Amaranths. Leaves are used as a 'pot' herb. Propagated from seed.

8. *Amaranthus spinosus* L. Fam. Amarantaceae. Tam. Mullukirai. Tel. Mullathotakura.

A common herbaceous annual weed, full of spines and resembles closely the other members of the genus *Amaranthus*. Stem is hard and often reddish. The leaves are used as 'pot' herb by the poorer classes. Propagated by seeds.

9. *Amaranthus viridis* L. Fam. Amarantaceae. Tam. Kuppaikirai.

An erect glabrous annual. Very much like the other members of the genus. The leaves are very commonly used as a 'pot' herb particularly by poor people. Propagated by seeds.

10. *Baselle rubra* Linn. Fam. Chenopodiacea. Eng. Indian Spinach. Tam. Pasalai kirai. Tel. Batchalakura.

A glabrous succulent climbing herb with small white or red flowers, grown in all districts and also wild. The leaves are alternate, broad, cordate up to 5″ long and 3″ board. It is a very popular vegetable in South Kanara and now grown all over the Presidency. The plant is easily propagated both by seeds and by stem cuttings.

11. *Brassica Juncea* Hook. and Thomas. Fam. Cruciferae. Eng. The Mustard; Tam. Kadugu; Tel. Avalu.

The plant which is a juicy herb is grown more in northern India than in the South for the sake of its seeds which are used as a spice and from which an edible oil also is extracted. The leaves of the plant are used as 'pot' herb by some people. Propagated by seeds.

12. *Brassica oleracea* Linn. var. *capitata.* Fam. Cruciferae. Eng. Cabbage. Tam. and Mal. Motta Khos or Khos kirai. Tel. Gosugadda,

The most popular European vegetable among the Indians is the *Cabbage* The plant is a low herbaceous annual thriving best 3000 feet above sea level. and therefore very widely cultivated on the hills and in all plains districts where there is a fairly cold winter. The cabbage has the best reputation among leafy vegetable being very rich as a food material. Propagation is by seed.

13. *Cardiospermum halicacabum* Linn. Fam. Sapindaceae. Eng. Baloon vine; Tam. Modakithan.

A herbaceous tendril climber common in wet lands, on the bunds of paddy, fields and banana and sugarcane plantations and other moist situations such as arecanut and coconut *topes* distributed throughout the East and the West Coast. The leaves are used as a 'pot' herb and they have distinct laxative properties. The plant is easily distinguished by its inflated capsules and tendrils. Propagated from seeds.

14. *Cassia tora* Linn. Fam. Caesalpinioideae. Tam. Tagara. Tel. Tantipu; Tulu. Twajang.

It is a common low shrub growing wild in waste places and fallow lands all over the Presidency and very luxuriant in Malabar and South Kanara. It is also to be met with on the hills up to 4000′. The flowers are yellow and the pods long and curved. The leaves are edible and various preparations are made of them. Propagated by seeds.

15. *Celosia argentea* L. Fam. Amarantaceae. Eng. The white cock's—comb; Tam. Korangu val chedi; Mal. Kozhi pulu.

The plant is a herbaceous annual, grows wild as a weed in dry soils often in such rank fashion that one easily mistakes it for a crop. The flowers are arranged in cylindrical spikes which are pinkish in the beginning and then become glistening white. These spikes are very conspicuous and enables one to identify the plant easily. Leaves are used as a 'pot' herb especially by the poorer classes of people. Propagated from seed.

16. *Celosia polygonoides* Retz. Fam. Amarantaceae. Tam. Eli katu kirai. A perennial herb of the Deccan and the Carnatic tracts and not found outside India. The plant is found wild in waste places. The leaves are used as a 'pot' herb by poor people. Propagated by seeds.

17. *Centella asiatica* Urban. Fam. Umbelliferae. Eng. Indian Pennywort; Tamil. Vallarai keerai; Mal. Kodangal. Tel. Saraswathi aku.

A prostrate stoloniferous herb. very common in moist places, particularly on the bunds of paddy field, sugarcane and banana plantations and also in coconut and arecanut *topes*, easily made out by its reniform fleshy leaves. The leaves are widely used as a 'pot' herb, considered to be a blood purifier. It is a good fodder and increases the secretion of milk in cows. Propagation by stolons and seeds.

18. *Chenopodium album* Linn. Fam. Chenopodiaceae. Eng. White goosefoot. Tam. Paruppu Kirai.

An erect annual herb growing sometimes up to 10 feet high and clammy to the touch. The plant is green or grey with white granular mealiness, the stems usually striped green or purple. Leaves are rhomboid, deltoid, entire or toothed. The leaves are considered very valuable as a pot herb and are therefore very popular and widely cultivated all over the Presidency. It is usually cooked with green gram. Propagated by seeds.

19. *Cissus quadrangularis*, Linn. Fam. Vitaceae. Tam. Perandai; Tel. Nalleru.

A much rambling shrub, the branches climbing over bushes to a long distance and found distributed in all the dry regions of the Madras Presidency. The quadrangular fleshy stem, the terminal tendrils and the small fleshy leaves enable the plant to be easily made out. The tender leaves and the young stem are after a little roasting made into a preparation called chutney or Thogaiyal. It is regarded as a tonic and stomachic. The plant propagates itself by its stem.

20. *Coleus amboinicus*, Lour. Fam. Labiatae. Tam. Karpuravallithashai.

This is a native of Malaya, a fleshy aromatic spreading herb, both wild and cultivated. The leaves which are fleshy are also very juicy and aromatic. They form a good leafy vegetable. Propagation is by soft wood cuttings.

21. *Colocasia antiquorum* Schott. Fam. Araceae. Tam. Sembu or Seppan, Tel. Kaladi. Chama.

A common herbaceous plant common in all moist situations from sea level up to 3000′ above S. L., both wild and cultivated. The sagittate leaves are characteristic of the plant and form an excellent pot herb. It is both wild and cultivated and there are a number of varieties also. The plant is propagated by the corm.

22. *Coriandrum sativum*, Linn. Fam. Umbelliferae. Tam. Kothamalli; Tel. Kothameir, Daniyalu.

A low much branched aromatic annual herb widely cultivated throughout the presidency. It has a deep tap root and the leaves are decompound. The

plant is grown both for the leaves and the seeds which are used as a spice. Propagated by seeds.

23. *Digera arvensis* Fam. Amarantaceae, Tam. Thoyya kirai; Tel. Chenchalikoora.

One of the most common herbaceous weeds growing in all kinds of soils and at its best in loamy soils of the cultivated fields. The plant is very popular as a pot herb with poor people. Propagated by seeds.

24. *Hibiscus cannabinus* L. Fam. Malvaceae. Eng. Bimilipatam Jute; Tel. Gonkura; Tam. Pulimanchi.

A tall undershrub with a sparsely prickly stem and a fairly deep tap root, commonly cultivated throughout the province and more extensively in the Circars and the Ceded Districts. The leaves on the main stem and on the axillary branches at the base are often undivided while those given off from the upper portion are palmately deeply lobed the number of lobes being from 3—5. The leaves taste slightly acidic and are a favourite with the Andhras. Recently the taste for the Gonkura preparations has extended into the Tamilian districts also. Propagation is by seeds.

25. *Hibiscus Sabdariffa* L. Fam. Malvaceae. Eng. The Red Sorrel, the Roselle.

This resembles very closely the former species and differs from it mainly in being pigmented. There is a red tinge about the whole plant, the pigmentation being marked in the stem and in the veins and in the calyx and the epicalyx of the flower. The leaves are slightly acidic as in the former case and are used in the same manner. Propagation is by seeds.

26. *Mentha Viridis* L. Fam. Labiatae. Eng. Spearmint. Tam. Putheena. Tel. Putheena.

A dwarf aromatic herbaceous perennial native to the temperate regions and therefore widely cultivated in the hills. It comes up well in the plains also. The leaves are used as a flavouring ingredient in various culinary preparations. It is considered to be a good stomachic. Propagated by cuttings.

27. *Moringa oleifera* Lamk. Fam. Moringaceae. Eng. The horse radish tree; Tam. Murungai. Tel. Munaga,

A graceful tree most popular and cultivated throughout the presidency, practically every house which enjoys a compound having one or more plants of this tree. The leaves are very good as a pot herb. It is easily propagated by stem cuttings and also by seeds.

28. *Murraya Koenigii* Spreng. Fam. Rutaceae, Tam. Kari vempu. Tel. Karepaku. Kan. Kari bevi.

A very common small tree, thrives very well in the Coimbatore district as also in other parts of Deccan and northern Circars. The leaves are rich in an aromatic oil. The plant is easily propagated by seeds. Root suckers are also employed in multiplying the plant. The leaves of coriander and murraya are the favourite flavouring leaves in all Indian preparations. Apart from its flavouring value, the leaves by themselves are an excellent food.

29. *Nelumbium speciosum* Willd, Fam. Nymphaeaceae. Eng. The sacred Lotus; Tam. and Tel. Thamarai,

A typical aquatic plant both wild and cultivated throughout the Presidency and a favourite with the Hindus as the flowers of the plant are used in worship in all temples. In all tanks especially in Malabar in or round about the temples

in the province this is grown. The petioles of the leaves are cut into small pieces, salted, sun-dried and fried in ghee or oil whenever required. Propagated both by rhizomes and seeds.

30. *Oxalis corniculata* Linn, Fam. Geraniaceae. Eng. Yellow wood Sorrel; Tam. Pulichai keerai.

A perennial stoloniferous herb wild in all moist places and in all elevations. The leaves are 3 foliolate. The plant has a preference for somewhat moist and stony localities in gardens and under fence and along ditches. The leaves are used by the poor people. Propagation by stolon and seed.

31. *Pisonia morindifolia* R. Br. Fam. Nyctaginaceae. Eng. The tree lettuce, Tam. Thevadial kirai; Tel. Lanjamunda aku.

The plant is small tree and a native of the beach forests of the Andaman islands. It is now very widely grown all over the Presidency as an ornamental plant on account of its pale green leaves. The tender leaves are used as a pot herb. Propagation easily effected by stem cuttings.

32. *Portulaca oleracea* Linn. Fam. Portulacaceae.

A prostrate succulent small herb common in all dry districts. The leaves are small and succulent. As the plant comes up profusely with rains, the poor people make use of the leaves as a vegetable. Propagation by seeds.

33. *Premna serratifolia* Linn. Fam. Verbenaceae. Tam. Minnal ilai, Minna kirai.

A small tree common on the coromandel coast. The leaves have a peculiar aroma and are used in flavouring culinary preparations. Propagation from seeds.

34. *Rumex Vesicarius* Linn. Fam. Polygonaceae. Tam. Sokka Kirai.

An annual herb cultivated very widely for the sake of its much relished leaves. The plant is recognised by the membranous pink or white reticulate inner fruiting perianth. Propagation by seeds.

35. *Sesbania grandiflora* Pers. Fam. Papilionatae. Tam. Agathi Kirai, Tel. Avrsaku.

The plant is a small soft-wooded tree reaching 20—30 feet high large showy red or white flowers and long cylindrical pods about a foot or more long. The leaves are pinnate compound, leaflets numerous and linear oblong. The young leaves are relished as a pot herb and in every orthodox Hindu house the leaves are cooked on the Dwadasi day. Throughout South India, milking cows are fed with it as it is believed to increase the secretion of milk. The plant is usually grown in betel vine gardens where it forms the support for the vine. Propagation is by seeds.

36. *Solanum nigrum* Linn. Fam. Solanaceae. Tam. Manathakali.

A common erect annual herbaceous plant growing as a weed both in waste places and cultivated fields in all Districts and at all elevations. The leaves are used as a pot herb. Propagation by seeds.

37. *Solanum trilobatum* Linn. Fam. Solanaceae. Tam. Thuthuvalai.

This is a prickly trailing or climbing undershrub. It is commonly met with as a weed in waste places. It thrives very well along the coast and also in black soils. The leaves are used as a pot herb. Propagation by seeds.

38. *Trigonella foenum graecum*, Linn. Fam. Papilionatae. Eng. The Fenugreek; Tam. Venthyakirai. Kan. Menthe soppu.

It is a herbaceous annual growing to a height of 10 to 12 inches. Leaves pinnately trifoliolate. The young plants are used very widely as a pot herb and are considered very nutritive. Propagation by seeds.

INDEX TO POPULAR NAMES

Posters for Agricultural Propaganda.

By R, RATNAM, B. A.,
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Objectives. The primary object of issuing a poster is to secure attention from the public with regard to the message contained therein. The reader should be instigated to think of the contents of the poster. People moving about in vehicles or on foot who see the poster should be attracted by it. Since such people should get at its meaning in a short space of time, brevity is an absolute necessity. In the field of trade, posters are used to remind people of the merits of known products, to create an interest in new things, and to inform the public of the locality wherefrom particular services or products can be had. By their very nature, posters cannot replace leaflets, since they can never be as comprehensive as leaflets can be. Posters appear to be necessary adjuncts to such popular literature.

Language. The Madras Province has as many as four major Indian languages, viz., Telugu, Tamil, Malayalam, and Kanarese. Posters which are useful exclusively for the rural folk and such others a majority of whom do not know English, have to be issued only in the language of the districts. There are, however, certain themes, for instance, those relating to trade or industry, which are intended primarily for urban areas where a large majority of English-knowing people are found, where it may be found more economical to issue only English posters.

Size. In foreign countries huge posters having a printing surface of 104 inches in height and 234 inches in width appear to be used particularly by commercial concerns. To serve as last minute reminders near point of sales, less huge posters measuring .48 inches in width and 82 inches in height are frequently used. In any case it appears very desirable to have uniformity in size for posters of the Agricultural Department as it would ultimately enable the Department to periodically change posters attached to permanent signboards that may in the long run be erected by the Department in permanent centres.

Use of Pictures. Inclusion in posters of pictures—either coloured, photographed or otherwise — seems to be of paramount importance in securing attention and for an effective setting and interpretation of the theme in the poster. Where the motive of any picture does not warrant the use of colours, it is a common experience to find that the background is always given in colour.

In dealing with the motive behind pictures which are used in posters advertising technique generally takes the following important points into consideration :—

1. Amidst the many details of the picture, the figure of the crop or other product which forms the subject matter of the poster should be included in the picture. For instance an advertisement for Ovaltine, a tooth paste or a boot polish invariably gives the exact figure of the package.

2. As regards the other details, the motive of the picture should be relevant to the subject matter. As an instance some of the photographs or drawings of men and women in happy pose included in advertisements for cigarettes or foods and drinks may be cited.

3. Grim suggestions which create a depressing attitude of mind should be avoided. For example, a picture of a coconut plantation or a single coconut tree devastated by the rhinoceros beetle would not be so appealing as a poster with the pictures of both good and bad plantations or trees, or merely the latter. Always the pleasanter or brighter side of any practice should be emphasized.

4. The pictures should be simple and not very puzzling to the reader. He should grasp its significance in the shortest space of time.

Head-lines. Without proper headlines, the poster is sure to lose its attractiveness. A mere mention of the subject, for instance, *Manuring Coconuts, Preparation of Cream Jaggery* or *Control of Mahali Disease of Arecanuts* would be less attractive than some of the following headlines: *Here's a CHEAP Manure for Coconuts, How to Prepare BETTER and CLEANER Jaggery, Save your arecanut Crop from Mahali Disease— Here's a Tested Method*. In compiling headlines it is a recognised principle to follow some of the following points:—

1. Headlines should be direct, sincere and simple.

2. They should suggest to the reader that the theme of the poster contains something which would benefit him and that too easily (e. g., the word *cheap* in the above headline for the manure for coconuts).

3. Headlines should not give a gloomy or negative side of any practice or circumstance. For instance, a headline with the words "Mahali disease is a terrible disease of arecanuts" is not desirable.

4. Brevity is absolutely essential.

5. If possible some "news" item may be added. For instance, if there is anything specially achieved by a manurial or cultural practice or by a new seed strain which is the subject matter of the poster, that "news" may well be included in the headline. (The words *a tested method* in the headline about arecanuts indicated in the foregoing paragraph pertain to a news item).

6. No headline should be in the manner of a puzzle, brain-teaser or a curiosity.

Message. In any poster the headline is followed by the message. Simple style of language centering round one or two ideas alone should be included in a single poster. A catchy but clear style may come in handy. No poster ever attempts to be exhaustive, and so suggestive phrases may well replace complete sentences. Variation in typography is an absolute necessity to relieve strain on the reader's attention. Finally the reader should be made to feel an urge to do a particular thing.

Testing the Effectiveness of a poster. Commercial concerns invariably test their advertisements for effectiveness before they are finally issued in view of the high cost involved. Several methods have been evolved and one of such methods is as below. A set of several posters on a single subject is got up with the variations in the picture, the headline, the wording of the message and different layouts in typography. Each poster differs from the other in only the detail, such as the picture, the headline etc. A number of persons who are truly representative of the group to whose benefit the posters are issued is chosen as a jury. The posters are mailed to them or presented by personal interviewers and they are asked the question: "Which poster would you be most likely to read first?". They are asked to give their preference and that poster which gets a high degree of preference is chosen for final printing and distribution. Where possible some such method may perhaps be followed in the Department to secure most effective posters.

Location. Posters should be found in places where the subject matter of particular posters are of general interest relating to the activities of the Department. For instance, a poster on proper harvesting of groundnuts should be found in a groundnut growing area, a poster on proper grading of ghee in a place where this work is being carried on, and a poster on cholam malt as a valuable infant and invalid food should be located in towns where a large number of people who are interested in the dietary requirements of infants and invalids live.

Season. So also the distribution of posters relating to subject matters of seasonal interest should synchronise with the appropriate season. For instance a poster on the avoidance of damping groundnuts before shelling should be situated not only in a place where decortication of groundnuts is done but should also be put up at the season when the harvest of groundnuts is just over and when the produce comes to factories for shelling. Instructions on the method of sowing or the recommendation of a new seed strain should synchronise with the sowing season of the particular crop in a given tract.

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Budama kaya (*Cucumis pubescens* Willd.)—an economic cucurbitaceous plant.

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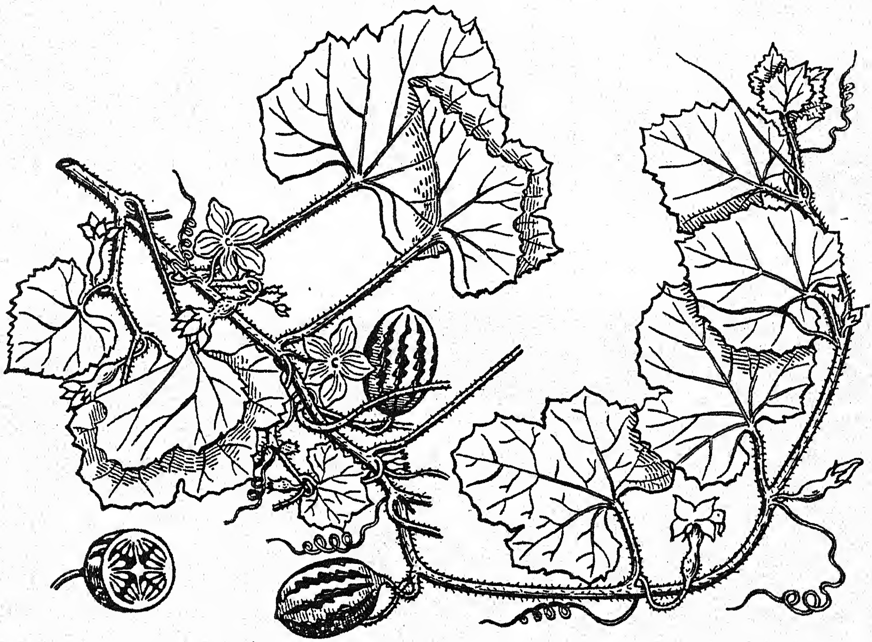
Introduction. There is considerable confusion in the nomenclature of *Cucumis pubescens* Willd. It is described by Hooker (1879) as *Cucumis trigonus* Roxb. Roxburgh (1832) describes this plant as *Cucumis madraspatanus* Willd. which the *Index Kewensis* (1895) incorrectly cites as a synonym of *Cucumis Melo* L.– the well known water-melon. It is figured in Wight's (1845) *Icones* tablet 496 under the Tamil name *Thummatti kai* and the Telugu name *Budama kaya.*



Cucumis pubescens, willd.

Description of the plant.

A trailing plant. Stems rough with short rigid hairs; branches often 3′—5′ long; leaves somewhat reniform, repandly and acutely toothed, scabrid on both surfaces, in some plants they are nearly entire while in others unequally 5-lobed; lamina 4—8·5 cm. by 5—10 cm.; petioles scabrous, 2—10 cm. long. Flowers yellow, petals slightly acute. Fruit ovate, obtuse at both ends, terete, striped dark and light green, 4—5 cm. by 2—2·4 cm. Seeds elliptic, 5 by 2 mm.

Distribution. The plant occurs in the Central and East Coast districts of the Madras Presidency on waste lands. It grows abundantly in many parts of the Salem district. It is a common weed especially in *cumbu* (*Pennisetum typhoides* Stapf et Hubbard) fields and after the harvest of *cumbu,* this plant trails on the ground between rows of field Lablab *(Dolichos Lablab* L.) and castor *(Ricinus communis* L.) which are generally grown

at 8′—10′ apart as a mixture with *cumbu*. The *cumbu* crop is generally harvested in December. Lablab and castor are harvested in February—March. In February, the ripe fruits of *Cucumis pubescens* Willd. are collected and cut into 2 or 3 pieces, often cross-wise and spread on bare rocks for drying. The pieces are collected when dried and stored in gunny bags. The tender fruits are bitter in taste. Ripe ones, however, are edible and pleasant to taste. Ripe fruits are used in making vegetable chips (*vattal*). It is a subsidiary occupation of the women-folk and children especially of Andipalayam, Oonjapalayam and other villages in the Salem District.

Each plant produces from 10—20 fruits. About 15 fruits are required to make ½ Madras Measure of the chips (dried stuff) which is known in Tamil as *Karumatta vattal*, *Kummatti vattal* and *Muruku vattal*.

Preparation (further curing). The "vattal" is soaked in good buttermilk in which ground chillies and salt to taste have been added and kept for a day. The next day they are put out in the sun for drying. They are again soaked overnight in the same buttermilk and are dried from the third day till they are completely dry. The finished product will keep for several months and is known to keep for two years. It is fried in oil and used as a savoury preparation to be eaten with rice.

Marketing. Traders either go to Sankaridrug shandy or to the villages where the "vattal" is available and buy and stock it in large quantities. They take it to important towns all through South India, viz., Coimbatore, Pollachi, Palghat, Calicut, Trichinopoly, Madura, Tinnevelly and Trichur. It is usually sold at two annas per Madras Measure. "Vattal" is available for purchase from March onwards.

Scope for cultivation. This "vattal" is cheap in Salem as it is produced largely in that district. It can easily be grown in almost all places in waste lands. Seeds can be obtained through the Agricultural Demonstrators in the Salem District.

Selection work in this crop is being done at the Agricultural Research Station, Nandyal, Kurnool District.

* The following are the analyses of "Budama" fruits and "Budama" chips.

	Budama fruits		Budama chips (Vattal).
	On original moisture basis.	On dry basis.	
	%	%	%
Moisture	89·10	9·22	7·38
Ash	1·31	10·88	10·96
Crude proteins	2·00	16·68	18·57
Ether extractives	1·99	16·56	17·45
Crude fibre	2·93	24·44	30·61
Carbohydrates by difference	2·67	22·22	15·03
Total	100·00	100·00	100·00
Insolubles	0·015	0·12	0·11
Albuminoids	1·58	13·19	13·89
Lime (CaO)	0·060	0·50	0·50
Phosphoric acid (P_2O_5)	0·073	0·61	0·43

* The analyses were done by the Government Agricultural Chemist, Coimbatore, at the instance of the Assistant Director of Agriculture, Cuddapah.

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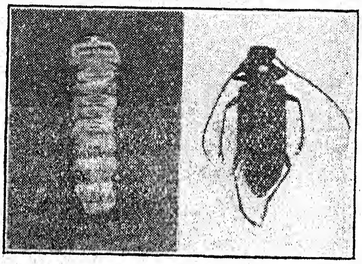
Research Notes.



Larva and beetle of Cashew stem borer.

A stem boring beetle pest of cashew tree. The cashew tree *(Anacardium occidentale)* is an important money crop in the South Kanara District. The area under the crop in this District is estimated to be 35,000 acres in 1940 and it is steadily increasing. The value of the annual produce of cashewnut in South Kanara amounts to one and a half million rupees in normal years.

No major insect pest of the cashewnut is so far reported. During the last four years, large numbers of cashewnut trees have been found dying all over the West Coast for no apparent cause. Several dead and dying trees were examined. Large numbers of live beetle grubs found inside the trunks were found to have caused damage and death of the trees. Specimens of grubs and adult beetles (plate) collected from the trunk were sent to the Government Entomologist in February 1940 and were identified as *Plocaederus ferrugineus*, Linn. family *Cerambycidae*. This was the first record of its kind in this Presidency; so far no cerambycid beetle grub has been known to attack cashewnut trees and do extensive damage. A survey in the South Kanara District has revealed that up to 10% of the trees were killed by this pest.

From the nature of the attack it is presumed that eggs are laid in the bark at the collar region. The grubs are pale brownheaded fleshy creatures about $1\frac{1}{2}''$—$2''$ in length. On hatching, they tunnel into the trunk eating their way upwards and inwards into the trunk and also downwards into the roots. They pupate below the bark in the tunnels in small cocoons of thin pale material and are found particularly in the collar region. The adult beetle is reddish brown in colour, about $1\frac{1}{2}''$ long and has long feelers.

The seat of first attack is the collar region of the tree at about the ground level. Usually, large, healthy and robust trees are attacked, small trees being comparatively free from attack. Affected trees are distinguished by characteristic yellowing and withering of leaves which may be confined to a few branches on the entire tree. Occasionally dried up, red coloured gum is observed in the crevices of the bark at the base of the trunk. On tapping the trunk of the affected trees a dull thud indicates the seat of attack. A healthy trunk produces a sharp sound when tapped. The bark when split open (which can be easily done) exposes a thick layer of grey coloured, powdered wood mixed with the excreta of the grubs between the bark and the wood. In neglected cases several months old—the trunk is tunnelled through and through. From one such specimen 250 grubs and a large number of beetles were collected. When the attack is serious the cambium between the bark and the wood is eaten up and the tree is

practically 'ringed' and it cannot be saved. The attack appears to be more severe in summer months.

Trees should be frequently examined at the collar regions for the presence of the pest. Affected parts should be scooped out and beetles and grubs extracted and killed and the operated parts painted with tar. Dead trees should be cut down and burnt, lest they should serve as breeding places for the pest.

Agri. Res. Station, Kasaragod, March 1941. G. V. Narayana.

ABSTRACT

Mango Budding. Ali Mahomed Ulvi—*Indian Farming* (1940): 222–225. This article relates to propagation of the mango by budding under Sind conditions.

Vegetative propagation. As seedling mango seldom resembles its parent tree either in form or quality of fruit, vegetative propagation by inarching or grafting is the general practice in India. Under Sind conditions this method is expensive due to plant potting, daily watering and preparing platforms on the parent trees for convenience of grafting. Besides the scion trees annually subjected to this grafting method at the Government Fruit Farm, Mirpurkhas, have been found to get devitalized and refuse fruiting. To avoid this difficulty and to meet the increasing demand for mango planting on the Lloyd Barrage and Canal areas, mango budding was tried at this station under field conditions, with 60 percent success. Some budded varietal plants planted in 1937 yielded a few bunches in 1939, and the fruits were typical of the varieties.

Technique of budding. Washed stones of mature ripe country mangoes of regular croppers, are planted 2 feet apart in previously prepared nursery beds. With light irrigation, top dressing and occasional weeding and hoeing, the stem of the seedling gets pencil thick in about a year, when the best of seedlings of about 3 feet height are budded in nursery beds. To ensure success the stock plants should be 1 to 1½ years old and pencil thick in stem. They should also be stimulated to flush with vigorous sap flow, for easy pealing off of the bark and smooth insertion of the bud.

Selection and treatment of bud wood. Healthy, non-flushing green shoots of 2 or 3 previous growths, carrying prominent and resting buds, are removed of consistently high yielding and vigorous scion parents of over 10 years of age. The top growths are cut. The bud woods of lower growths are divided into one foot long bud sticks, kept cool and moist inside fresh plantain skin, and the buds utilised almost immediately for budding.

The budding operation. About 2 inch long buds are removed from the bud sticks, cleaned off the wood, and inserted at the middle of a longitudinal slit caused by bending at the centre of a 2 to 2½ inch long incision made on the stem of the stock about a foot high from the ground. The budded region of incision is bandaged with moist plantain fibre, just exposing the living bud for growing. Watering, top-dressing, hoeing, removal of adventitious bud sprouts, light and sun are essential for stimulating bud growth. In one year the budded plants are ready for planting in the field after careful lifting with ball of earth. Two or three year old seedlings planted permanently in the field can also be budded *in situ* on the limbs.

S. M. R.

Studies on Browning Root Rot of Cereals. VI. Further contributions on the effects of various soil amendments on the incidence of the disease in wheat T. C. Vanterpool. *Canadian Jou. of Res.* 18 (1940): 240.

Further work has substantiated earlier findings that phosphatic fertilizers and farm manure will give adequate control of *Pythium* root rot of wheat in infested prairie soils. The improvement in growth resulting from these amendments is considered to be due to the production of a larger number of quicker

growing roots which lessens the chances for infection and leaves more roots healthy, though the same percentage may be effected as in diseased plants showing severe leaf discolorations. Experiments have failed to indicate that the phosphatic materials increase resistance appreciably. Nitrogenous materials when applied singly had virtually no effect on growth, but once ample phosphorus was added, further nitrogen applications gave substantially greater increases than phosphate alone. Phosphorus is apparently the chief limiting element. No difference was found in preliminary tests in the phosphate-fixing power of browning and normal soils. Typical browning soils responded irregularly to small applications of boron, copper, manganese, or zinc, but were not found to be seriously lacking in these elements. Moderate benefits resulted from heavy applications of gypsum and sulphur. Browning soil was found also to be deficient in phosphate for non-cereals such as alfalfa, buckwheat, carrots, flax, lettuce, and sweet clover. These crops were not attacked by the *Pythium* spp. pathogenic to cereals. Consequently the poor growth of the non-cereals in browning soil appears to be due to nutrient deficiencies, while the poor growth of cereals is due to both root-destroying fungi and nutrient deficiencies. In both instances phosphorus is probably the chief limiting element. Ground cereal straw, sweet clover hay, and weed hay amendments gave moderate increases in the growth of wheat. No consistent differences were found in the carbon-nitrogen ratios of browning and normal soils. The results as a whole suggest that two of the most practicable means of meeting the browning root.rot situation are, firstly, to supply supplemental nutrients in the form of artificial fertilizers; and secondly to add organic residues or farm manure regularly to fields subject to the disease. (Author's abstract.)

Coffee manuring and mulching experiments A. B. Lucy. *Malayan Agr. Jou.* 29 (1941 : 68—77).

The paper records the results of a manurial experiment on Liberian and Robusta coffee laid down in 1933 and of a mulching experiment superimposed on the plots in 1938. There were four manurial treatments viz. NPK, NP, P, P+ green manuring and a control all of which were replicated six times. The mulching was done to half-block units after splitting each plot longitudinally so that the mulching did not interfere with the manurial experiment. The application of rock-phosphate at the rate of 4 cwts. per acre per annum gave a mean increase of 26 percent. Green manure dug in at the rate of 2 tons per acre together with 4 cwts. of rock-phosphate gave a mean increase of 55 percent. Small applications of nitrogen and potash in conjunction with phosphate gave no further increases in yield. The bushes showed noticeable improvement four months after the application of mulch, but no appreciable yield was obtained in the first year. During the second year an increase of 127 percent yield was obtained. Mulch alone gave 55 percent greater yield than the best of manurial treatments. The response of Robusta coffee to mulching was similar but less marked than in Liberian coffee. The increase in yield was 59 percent. K. M. T.

A quantitative study of the Subterranean Members of Soybean. Howard J. Dittmer, *Soil Conservation*, 6, (1940), 33—34. Soil samples 3 inches in diameter and 6 inches deep were taken with a cutting tube, and counts and measurements were made of the various root parts and root hairs included in the soil sample. The tool used for sampling was an iron pipe with an inside diameter of 3 inches and a tapered cutting edge to facilitate entrance into soil when driven with a heavy maul. The soybean was selected for this study because it is of great economic importance and is widely used in crop rotation even on fields subject to erosion. The taproot system of soybean is very poorly adapted for erosion control since most of the branching is from one to two inches below the surface thus giving the top soil very little protection. The total surface area of the

root, the number of roots, the total length of roots and total number of root hairs and their surface area were considerably less in soybeans as compared with oats, winter rye and Kentucky bluegrass. It is therefore concluded that the binding capacity of soybean to prevent soil erosion is rather poor though the depth of penetration is rather high. It is also concluded that the soil binding potentialities of a plant may be determined in a very short time by making quantitative studies of its roots and root hairs. R. R.

The Feeding of Poultry. A. J. Macdonald. *Indian Farming* (1940) 318—322.

India has lagged very far behind other countries in poultry breeding and possesses only a very small percentage of pure-bred fowls. The ordinary country fowl is a comparatively slow grower and the average annual production of a bird is calculated to be only 52 eggs. This production is less than one half of that obtained in many other countries. The average egg size is also very much smaller than the standard 2 oz. eggs of well-bred strains of poultry. Efforts at improvement by breeding without corresponding advances in management and feeding are, however, of doubtful value for it is only logical to assume that fast growing high producing stock must receive more nutritive foods than ordinary unimproved country stock. Points to be observed regarding poultry rations: (a) Fowls can deal fairly effectively with rations containing up to 10% fibre, but better results are obtained from rations containing only 6—7%. (b) Stale musty foods of any description are harmful as they are unpalatable and cause serious digestive disturbances. (c) Cereals as a class are deficient both in the quantity and quality of their proteins thus making it necessary to balance these deficiencies with suitable protein supplements. (d) The early stages of growth are the most critical period in the life of the fowl and it is during this time that the biggest losses occur from malnutrition. Numerous growth experiments have demonstrated that the best growth results obtained during the first eight weeks of life are derived from rations containing not less than 18% proteins and that rations containing less than 15% proteins result in very poor growth and high mortality. (e) The best protein supplement to cereal rations for young chicks is undoubtedly milk in some form. Fresh milk, sour milk and buttermilk have equal feeding values. (f) When milk is not available, good results can be obtained by feeding cooked meat offals mixed with other ingredients in the mash. (g) In coastal areas where fish is plentiful, good results can be secured by using fish as the protein supplement—20% cooked fish or 10% fish meal or sun dried fish should prove satisfactory. (h) Vegetable proteins in the form of soya bean meal or earthnut meal may be given when other protein supplements are not available. Satisfactory results with vegetable proteins can, however, only be obtained in conjunction with ½—1% common salt. (i) The protein requirements of well-grown chicks are considerably smaller after 10 weeks and. consequently, it is less essential. (j) Cereals are badly balanced and deficient in their mineral content. Calcium in the form of limestone or other shell products given generously will produce good results. (k) The feeding of complex mineral mixtures is neither necessary nor advisable. (l) The protein requirements for egg production are not so high as those for young chicks. Satisfactory egg production can be maintained on a ration consisting only 12·5% protein but as most cereals contain less, it is advisable to feed some extra protein of either animal or vegetable origin. (m) Vitamin requirements: Vitamin A, is most likely to be deficient, more especially if the birds are confined in small runs. Deficiency of this vitamin results in poor growth, abnormal infection of the eggs, poor hatchability and low egg production. Yellow maize is a fairly good source of this vitamin and it should form one of the main cereals in the ration. Succulent green food must be fed abundantly. Vitamin B. (growth promoting vitamin).

Deficiency can be guarded by feeding separated milk and green food. (n) A mixture of grains should always be used in preference to a single grain as the proteins of a mixture are more likely to be well balanced than the proteins from any one source. (o) Wet mash is more palatable than dry mash but wet mash feeding requires more labour and involves a higher degree of skill in its use. Experimental work points to there being little to choose between the two systems. M, K. R.

Gleanings.

The Soya Bean in Dietetics. The soya bean has been described as vitally important to Germany from the nutritional, the economic, and the military standpoint. A correspondent in the "Times" described a few weeks ago (Times, April 23, 1940) how these "Nazi Food Pills" were playing a dominant part in supplying the protein missing in a diet in which foodstuffs of animal origin were likely to be deficient. A flour from the soya bean containing 40 to 45 per cent. of protein has been made and is incorporated in soups, sausages, bread, biscuits, macaroni, etc., in such a way that flavour is unimpaired and the food value greatly increased. From the military aspect it has been openly boasted in Germany that without soya flour the rapid advances of mechanized units, cut off by distance from food supplies, would not have been possible. Even allowing for the flights of imagination which colour reports from the Reich, it is clear that the possibilities of the soya been require more consideration than is usually given to them by dietetic experts in this country. A recent account (Arch, Dis. Childh., 1940, 15 1) by Dr. Helen Mackay of the use of soya bean flour in infant feeding is therefore of more than usual interest. The flour used contained over 40 per cent. of protein, 20 per cent. fat, and 20 per cent. carbohydrate. It contained about a quarter as much calcium, half as much phosphorus, and about eight times as much iron as dried cow's milk. For the investigation the soya flour was mixed with equal parts by weight of full-cream dried milk. When reconstituted with the usual "one in eight" dilution this mixture gave a feed with a caloric value equal to that of liquid cow's milk. Babies were given this milk, while a control group had dried milk with added iron. All babies received orange juice and some form of vitamin D and from 6 months of age all began mixed feeding. Babies accepted for the final comparison of results numbered 150. It was found that those receiving the soya flour milk gained on the average a little more slowly in weight than the controls. but the difference was less than two ounces a month. The haemoglobin levels of the soya flour groups remained very slightly below that of the controls, who had extra iron, and the total morbidity rates were almost the same in the two groups. There was, however, a greater tendency to loose stools when soya bean flour was used, and apparently it was not so well tolerated as full-cream dried milk and must be introduced more gradually. Calcification of the bones was as good in the soya bean groups as in the controls. Dr. Mackay has proved that in the mixture described, soya bean flour can play a part in infant feeds and soya bean flour should make it possible to market a milk plus flour powder at a price much lower than that of full-cream dried milk. Writing at a time when the possible stringencies of war economy were not fully realised, Dr. Mackay concluded that "owing to its relative cheapness it (the soya bean flour milk mixture) merits an extended trial in countries where, for economic reasons, a satisfactory substitute for breast milk has hitherto been unobtainable." The story of the "food pills" in Germany suggests an even wider application of soya flour. Infant feeding provides a delicate test for a substitute material, and out of such a test in D Mackay's hands the soya bean emerges with great credit. The main sources f the plant are Manchuria, the united States of America, the Balkans, and Sout Russia. It

is to be hoped that someone in the Ministry of food is interested in the Soya Bean. (*Jour. Jam. Agri. Soc.* 42 (1940) : 397.)

School children and rats. The Hawaiian coffee industry in Kona coast suffered a great damage by rats in 1929. The rodents climbed the bush, ate the tender young shoots and knocked off half the ripe cherries to the ground. During 1936 the Agricultural Adjustment administration set aside 4000 dollars for the eradication of the rodents and in recent years private subscriptions plus an assessment of 20 cents per acre of coffee was levied. Both poisons and trapping have been resorted to.

"Probably the school children of Kona have taken the greatest interest in the eradication progress because they received a *bounty* of 1 cent per tail. The school children brought the tails to school and were—there. They generally brought the whole rat along!" *Extension Service Review* Vol. II. 1940.

GUMMOSIS OF CITRUS

Symptoms. An examination of a tree affected with this disease will show that infection usually starts at the base of the trunk or on the crown roots and works rapidly both upward and laterally. The lesions are usually found on the trunk near the soil and the larger main roots and may occasionally be found on the branches higher in the tree. Patches of bark are killed and often large quantities of gum are exuded.

The bark of an infected tree is killed entirely through to the wood, thus including the cambium. Occasionally in the earlier stages of the disease the exuding gum is the only external symptom readily observed. By lightly scraping the bark at this time the margin between the sound and invaded tissue is shown indefinitely only by a gradual shading of the normal green colour to a drab. Only after a considerable time does the bark shrink and crack longitudinally. The inner bark and finally the wood underneath frequently decay and develop, especially in humid climates, an ill-smelling odour. The bark eventually dies and breaks away in patches leaving bare, dead areas.

The effect of this disease on the foliage often does not appear for many weeks or even months after the bark has been killed. The leaves on the side of a tree badly affected, or all over a tree that has been girdled, first fade to a yellowish green and later become yellow or chlorotic and finally fall leaving bare branches. The green bark on the twigs also turn yellow later and smaller twigs die at their tips. Trees attacked by this disease at times put on temporarily a heavy crop of inferior fruit.

METHODS OF CONTROL.

Preventive Measures. Keep the soil pulled away from the base of the tree trunk until the tops of the first main roots are exposed. Keep the soil next to the trunk from becoming excessively wet. Avoid injuries to the bark. Paint the trunks with a fungicide, such as Bordeaux paste. Use good sour orange or other resistant stocks budded high for all new planting, especially on heavy clay soil.

Treatment of diseased trees. The disease may be treated when not too far advanced by cutting away the invaded, killed bark, but not necessarily the outer gummous zone, and painting the wood with Bordeaux paste. After a few days and so as to prevent duck ants, other wood boring insects or rots from attacking the exposed wood, paint the wood with white lead. When branches are already dead or greatly weakened by the disease, sever them cleanly by using a saw and then paint the cut surface with white lead well under the diseased part. Cut back or thin the tops of trees severely affected. *Jou. Jam. Agr. Soc.* 44 (1940) 274—275.

Thin Napier Grass. In our search for a drought resistant grass, we came across, in our old collections, a tall thin variety which we have named dry land thin Napier grass. As generally recognized, Napier grass or *Pennisetum purpureum* is a tall, heavy stemmed grass with rank growth, but the one we have chosen is a thin stemmed variety. The heavy stemmed variety has a longer flower spike than the thin stemmed one. In 1937, enough seeds of this grass were collected for planting 15 acres. The seeds are light, with long hairs. The best method of establishing a pasture with this grass is as follows:

A raised seed bed is prepared similar to the one used for raising a tobacco nursery and manured with farmyard manure. The seeds are sown and the soil lightly raked and watered so as to fix the seeds in the soil lest they should be blown off by the wind. To facilitate sowing, the seeds may be mixed up with a small quantity of fine dry earth. The seeds germinate readily and the seedlings grow up to a height of about nine inches after 40 to 50 days.

With seedlings raised from a pound of grass seeds, an area of about 1½ acre can be planted. The land intended for planting with grass needs only to be ploughed up. It is not even necessary to manure the land, though no doubt manuring will result in a more luxuriant pasture. The seedlings are transplanted during the rainy season. A little occasional cultivation helps to keep down undesirable weeds, but even this may not be essential if we have an inter-crop.

Long after the other grasses have dried up, the thin Napier grass kept its fresh green verdure. It grows up to a height of five feet on the poorest land and will reach up to six feet on ordinary cultivable soils. Three cuttings can be taken in a year giving a yield of seven tons per acre of green fodder. By these repeated cuttings, the grass remains tender and does not become fibrous. It furnishes green fodder for nearly nine months in the year. Cattle and sheep relish the grass. On the Hebbal Farm our Merino flock, imported from South Africa, graze with avidity on the Napier Grass pasture of 15 acres. Given irrigation facilities and a mind to apply manure, the output of green fodder will be more than doubled.

It must be mentioned that Napier grass has grown well, not only in dry areas with only 18 inches of rainfall but in areas with rainfall of 120 inches.

Indian Farming 1 (1940): 586—587.

DEODORISING COCONUT OIL.

The following process was worked out at the Harcourt Butler Technological Institute Cawnpore.

The process consists in boiling for a few hours the coconut oil to be deodorised with a 2 per cent solution of sodium silicate, removing the soap formed and finally washing and drying the oil. The weight of sodium silicate used for a given quantity of oil depends upon the free fatty acid content of the oil and the alkalinity of the silicate. The quantity of sodium silicate taken is such that its alkalinity is exactly equivalent to the acidity of the oil. Usually with an oil of 3 per cent acidity, the quantity of sodium silicate of 240°Tw. required is 1·6 lbs per 100 lbs. of the oil.

The oil, taken in a vessel with a tapering bottom and a stopcock, is heated to about 80°C. and its equivalent of 2 per cent. silicate solution previously warmed to about 50°C, is poured slowly into it with vigorous stirring. The heating is continued for some time till the liquid comes to boiling. Then as the boiling goes on, water is poured in from time to time to make up the loss by evaporation and this is continued for 2½ hours. By this time the issuing steam is found to have hardly any odour of coconut oil. At this stage about 5 lbs. of powdered common salt are added, and the whole boiled for a few minutes to coagulate the

soap formed. The liquid is then allowed to stand, and the emulsion of soap and silicic acid is carefully drawn off from the bottom. The residual oil is given two or three washings with hot water, till the wash-liquid no longer gives any alkaline reaction. After every washing the wash water is drawn off from the bottom. The washed oil is then heated in a shallow dish with constant stirring to drive off any residual moisture.

The oil may finally be mixed with 1 per cent "diatomite earth" (Fuller's earth) and filtered, when the oil is perfectly clear, bright and without any perceptible odour. *Industry* 31 (1940): 518.

Reviews.

Fruit culture (with special reference to East Godavari District) by Rao Sahib G. Jogiraju, Retired Assistant Director of Agriculture, Pithapuram. Price As. 4.

This book-let of about 30 pages was published under the auspices of the East Godavari Horticultural Society, Cocanada. It deals briefly with the main principles of fruit culture and also offers some practical hints with special reference to the conditions prevailing in the East Godavari District. This book along with the author's other publications *Fruit* (parts I & II) in Telugu, supplies a long felt need of the fruit growers of the Northern Circars. No emphasis is laid on the importance of propagation from parent trees of proved merit. Bud selection is an important aspect of fruit culture especially in commercial orcharding and we hope in subsequent publications this aspect will also be included. T. N.

Report on the Marketing of wheat in India, issued by Agricultural Marketing Adviser, Government of India. *Manager of Publications, Delhi. Re 2—4.*

Wheat appears to have been cultivated in India from time immemorial. Grains unearthed from the 3,000 years old ruins of Mohenjo-daro in the Indus valley have been identified as *Triticum compactum* (dwarf) and *Triticum sphaerococcum.*

Supply. The world production of wheat in 1909—1913, including Russia was approximately 100·6 million tons, of which India's share was 9 5 millions. According to the latest available statistics covering the crop year 1935—1936, India produced 7·8% of the world crop. The estimated annual production in the Madras Presidency ranged from 2,300 to 3,800 tons.

Exports of wheat were a normal feature of India's foreign trade before the last war. In the five years immediately after the war owing to increasing domestic consumption and declining exports.Indian shipments had fallen to less than 3% of the average crop. Between 1928—1929 and 1931—1932 India was a net importer of wheat.

Distribution of area. Ninety-six per cent of the total wheat crop is found north and west of a line drawn across the Peninsula from Bombay to Calcutta.

The total area of wheat in India based on the average of the seasons 1925—1926 to 1934—1935 is 33 2 million acres and represents rather more than one-tenth of the total cultivated area in the country.

	Average area under wheat	
	Million acres.	*Percentage of all-India acreage.*
British India.		
Punjab	9.4	28·2
United Provinces	7·5	22·6
Central Provinces	3 4	10·2
Bombay	1·6	4·8
Sind	·6	1·8
Other Provinces	2·4	7·2
Indian States	8·3	25·0
Total.	33·2	100·0

In the Madras Presidency the average area under wheat in the ten years 1925—1926 to 1934—1935 was 18,232 acres. Taking the average yield to be 350 lb. per acre, the average annual production is about 2 630 tons.

Area under wheat in Madras Presidency. 1934—1935.

	Acres	Percentage of total area in the Presidency.
Bellary	4.158	24·9
Nilgiris	2,294	13·8
Anantapur	2,238	13·4
Vizagapatam	2,050	12·3
Kurnool	1.577	9 5
Salem	1.469	8·8
Madura	1,059	6·3
Cuddapah	910	5·5
Guntur	432	2·6
Chittoor	272	1·6
Rest	below 100	below 1%
	16,669	99·8

Area of irrigated and unirrigated wheat in India.

Quinquennial averages in million acres.

	Year.	Irrigated.	Unirrigated.
a)	1909-10—1913-14.	10·0	17·6
b)	1929-30—1933-34.	12·1	19·6

Approximate yields of wheat in certain countries of the world (lb. per acre)

United States	846
Canada	972
Australia	714
Argentine	780
Europe	1,146
Russia	636
India	636

Average yield of wheat in certain provinces of India (lb per acre).

Punjab	738
United Provinces	786
Central Provinces	444
Bombay	447
Bihar and Orissa	882
Sind	593
Hyderabad	231
Madras	350

Periodicity. Wheat takes 3 to 6 months to ripen according to the location and variety. In the south, the growing period is shorter than the north. By the beginning of December, the entire wheat crop is seeded in India.

Between 50 and 60 per cent of the total supply is marketed soon after harvest from the beginning of April until the middle of July before the monsoon interferes with the free movement of produce in the interior.

In the Madras Presidency the crop is sown early in November and is harvested by February—March. The produce arrives in the market from the end of February to October.

Qualities and types. The two main kinds of wheat grown in India are those belonging to the *vulgare* and *durum* sub-species of Triticum. A third type (*Triticum dicoccum*) referred to as 'spelt' in some recent publications is found in

the Bombay Presidency, and to a very small extent in Madras and Mysore. Dwarf wheats *T. Compactum* were formerly cultivated on a fairly large scale in the south and south-west Punjab, but the production of this species appears to have declined and is at all events of no special commercial importance.

Triticum vulgare. These are the common wheats used in large quantities by the milling industry for the manufacture of flour. They are grown extensively under irrigated and unirrigated conditions in the north. The grains are usually of medium size, and may be white or red, while the kernel structure ranges from soft to hard. All the improved varieties may be classified as white wheats. The total area under improved wheats in India is now about 6·5 million acres representing 19% of the total wheat acreage.

Triticum dicoccum. Summer wheat is found only in the south of India and mainly in the Bombay Presidency. A number of recent publications refer to this wheat as "spelt". The grain is red, hard and flinty, slender and pointed and is enclosed in the glumes when threshed.

Triticum compactum. This is grown in the south-west Punjab. The grains are usually white, small and rounded.

Triticum durum. These are also known as Macaroni wheats. The ears are long, pointed, hard and flinty. This has a high gluten content. The wheat is usually white or amber coloured and sometimes red.

Trade descriptions. There is a confusing multiplicity of trade names and descriptions of wheat throughout India so that buyers and sellers using the same term may often mean something entirely different. The more generally understood descriptions perhaps are "sharbati" for hard, white wheat and "pissi" for soft wheat (*Triticum vulgare*). "Dara" approximates to "fair average quality" in different districts and "bansi", "jalalia" and "khandwa" refer to different types of *durum*.

Imports. The wheat imports amount to very little and only partly off-set the exports. During the ten years ending 1929—1930, imports represented only about half the exports. Australia provides nearly all the imported supplies.

Imports of wheat into India by sea.

Year.	*Thousand tons.*
1930—1931.	232
1935—1936.	13

Sea-borne imports of wheat into the Madras Presidency were as follows:—

Year.	*Tons.*
1930—1931	6.655
1934—1935	8,331

Exports. The exports of wheat mainly to the United Kingdom has always been irregular and the average in recent years has been small.

Exports and re-exports of wheat from India by sea.

Year.	*Thousand tons.*
1930—1931	197
1935--1936	10

The exports of wheat from Madras Presidency to foreign countries are negligible, as they averaged less than a ton per year.

Wheat flour. The overseas trade in wheat flour and other wheat products is comparatively small. Imports of flour are almost negligible.

Utilization and demand. The consumption of wheat is as high as 350 lb. per head a year in some of the cities in Northern India. In the south, in Madras Presidency, the per capita consumption is as low as 4 lb. per year.

Ata is the main product made from wheat. Next to *Ata*, *Suji* (coarse semolina and *rawa* (fine semolina) are the most important chiefly *Suji*. The hard *durum* wheats are eminently suitable for the manufacture of these products.

Whole-sale prices. White wheats command a premium generally of about Re. 0—2—0 per maund over red wheats. Soft wheat *pissi* is at a discount of about 5 per cent compared with hard wheat *sharbati*. Durums, the hardest wheats of all, sometimes sell in some markets at high premiums over other wheats.

Average whole-sale prices of wheat (per maund of 82·2 lb.) at some of the important markets in India.

		1931.	1935.
Lyallpur	Rs.	1-13—6	3—3—9
Karachi	,,	2—6—3	2-14-10
Calcutta	,,	2-14—7	3—6—2
Hapur	,,	2—2—4	2—8—7
Bombay	,,	2—9—9	3—2—6

There is a seasonal depression in prices of wheat at harvest time. The producers lack facilities to be in touch with the "futures" markets.

Classification, grading and standardization. It is quite necessary to classify the different types of wheat into their various categories. *Triticum vulgare* may be classified as hard or semi-hard white wheats, soft white wheats hard or semi hard red wheat and soft red. Durum may also be classified as white (or amber) and red.

Conservation. Many and various are the methods of storage practised throughout India from small woven *pallis* or *thekkas* in the villages holding only a few maunds each to the large godowns at the posts capable of storing hundreds of tons. Owing to defective storage, large losses are incurred every year by dampness and weevils as well as other vermin such as rats and white ants. The total loss is about 3 lakh tons a year valued at over Rs. 2·4 crores. Every inducement and ecouragement should be given to trade associations or others operating in the large up country assembling markets to concentrate and improve the storage accommodation and to make available a reliable system of 'hedging' wheat stocks on the basis of standard 'futures' contracts capable of being dealt in not only by local traders, but also by buyers in the more distant consuming markets.

The processing and distribution of wheat products and the sources of supply and methods of distribution of seed are also exhaustively dealt with in the concluding chapters of the report.

On the whole the report is a compendium of valuable information on the importance of wheat to India, the varieties cultivated, the internal and external markets etc. The inter-chapters which form a feature of the reports in this series furnish the outstanding information in a nutshell. The facts are presented in lucid language and form interesting reading. The price of Re. 1—4—0 is very moderate for such a valuable book which should find a place on the bock-self of every person interested in Indian wheat. P. A. V.

Crop and Trade Reports.

Statistics—Crop—Groundnut—1941—First report. The area sown with summer or irrigated groundnut during the three months January to March 1941 is estimated at 33,500 acres. When compared with the estimated area of 42,800 acres for the corresponding period of last year, there is a decrease of 21·7 per cent, the decrease being due mainly to the low price of groundnut.

Figures by districts are given below:—

District.	Estimate of area sown with irrigated groundnut from January to March		Increase (+) or decrease (–) of the area in col. (2) as compared with the area in column (3)
	1941	1940	
(1)	(2)	(3)	(4)
	Acres.	Acres.	Acres.
Anantapur	200	200	Nil
Cuddapah	1,500	2,000	– 500
Nellore	100	100	Nil
Chingleput	5,000	6,000	– 1,000
South Arcot	16,000	20,000	– 4,000
Chittoor	3,500	5 000	– 1.500
North Arcot	1,000	1,500	– 500
Trichinopoly	800	1,000	– 200
Tanjore	1,900	3,000	– 1,100
Madura	2,500	3,000	500
Ramnad	1,000	1,000	Nil
Total	33,500	42,800	– 9,300

The wholesale price of groundnut (shelled) per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3 200 tolas) as reported from important market centres on 7th April 1941 was Rs. 3—12—0 in Vizagapatam, Rs. 3—10—0 in Guntur, Rs. 3—9—0 in Cuddalore, Rs. 3—8—0 in Vizianagaram, Rs. 3—3—0 in Vellore, Rs. 3—2—0 in Salem, Rs. 3—1—0 in Cuddapah, Rs. 3—0—0 in Bellary, Rs. 2—15—0 in Adoni, Rs. 2—14—0 in Guntakal and Hindupur, Rs. 2—13—0 in Tadpatri and Rs. 2—10—0 in Nandyal. When compared with the prices on or about the same date last year, these prices reveal a fall of approximately 41 per cent in Nandyal, 39 per cent in Tadpatri, 35 per cent in Cuddalore, 33 per cent in Hindupur, 32 per cent in Adoni, Cuddapah and Vellore, 29 per cent in Guntur and Bellary and 26 per cent in Vizagapatam and Vizianagaram.

(From the Director of Industries and Commerce.).

Statistics—Crop—Gingelly—1940-41—Fourth or final report. The average of the areas under gingelly in the Madras Province during the five years ending 1938--39 has represented 16·2 per cent of the total area under gingelly in India.

The area sown with gingelly in 1940—41 is estimated at 752,400 acres. When compared with the area of 803,900 acres estimated for the corresponding period of last year, it reveals a decrease of 6·4 per cent. The present estimate reveals an increase of 2·4 per cent as compared with the finally recorded area of 734,496 acres last year. The area in an average year is estimated at 785,740 acres.

194,100 acres have been reported as sown since the previous forecast report was issued in January as against 202,000 acres during the same period last year. These late sowings were mainly on wet lands in Vizagapatam, East Godavari, West Godavari, Cuddapah, South Arcot, Chittoor, Trichinopoly and the South where gingelly was raised as a second crop after paddy.

The estimated area is the same as that of last year in South Kanara. An increase in area is Estimated in East Godavari, Cuddapah, South Arcot (+23,600 acres), Chittoor. Coimbatore, Trichinopoly, Tanjore, Tinnevelly (+50,200 acres) and Malabar and a decrease in area in the other districts of the Province, especially in Anantapur (–11,400 acres) and Salem (–33,000 acres). The area estimated for South Arcot is the highest reported in recent years.

The yield is estimated to be above normal in Kurnool (105) and Salem (110), normal in East Godavari, Guntur, Cuddapah, Coimbatore and Madura and below normal in the other districts, especially in Tanjore (74), South Arcot, Chtttoor

North Arcot and Ramnad (80 in each), Tinnevelly (81) and Malabar (82). The condition of the late sown crop is reported to be satisfactory.

The seasonal factor for the Province as a whole works out to 92 per cent of the average as against 90 per cent according to the Season and Crop Report of last year. On this basis the total yield works out to 92,400 tons. This represents an increase of 2·8 per cent when compared with the estimate of 89,870 tons in the Season and Crop Report of last year. The yield in an average year is estimated at 106,320 tons.

The wholesale price of gingelly seed per Imperial maund of 82$\frac{2}{7}$ lbs. (equivalent to 3,200 tolas) as reported from important markets on 7th April 1941 was Rs. 7—0—0 in Cocanada, Rs. 6—12—0 in Tinnevelly and Tuticorin, Rs. 6—9—0. in Trichinopoly, Rs. 6—3—0 in Cuddalore, Rs, 6—1—0 in Salem, Rs. 6—0—0 in Vizagapatam and Vizianagaram, Rs. 5—15—0 in Ellore and Rs. 5—14—0 in Rajahmundry. When compared with the prices published in the last report, i. e., those which prevailed on 10th February 1941, these prices reveal a rise of approximately eight per cent in Vizagapatam and Cocanada, four per cent in Ellore, two per cent in Trichinopoly and Tuticorin and one per cent in Rajahmundry and a fall of approximately four per cent in Cuddalore, the prices remaining stationary in Vizianagaram, Salem and Tinnevelly.

(*From the Director of Industries and Commerce*).

Cotton raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 11th April 1941 amounted to 102,745 bales of 400 lb. lint as against an estimate of 410,400 bales of the total crop of 1940—41. The receipts in the corresponding period of the previous year were 87,855 bales. 110,208 bales mainly of pressed cotton were received at spinning mills and 21,182 bales were exported by sea while 46,612 bales were imported by sea mainly from Karachi. (*From the Director of Agriculture, Madras*).

Mofussil News.

Bellary. An Agricultural Exhibition was held during the car festival of Sri. Basaveswara Swami of Rurugodu, from the 13th to 15th of March by the Agricultural Demonstrator, Bellary. This was the first time that an exhibition was staged at this place. Improved ploughs suitable for both black and red soils, improved strains of seed suitable for the tract and bee-hives which were on show attracted considerable attention. Leaflets were freely distributed and priced publications were on sale. An attendance of 3000 persons was estimated which should have been doubled had it not been for severe out-break of plague in the surrounding villages. The President and members of the Panchayat Board of Kurugodu have requested the department to make the show an annual feature, as it has been of great educative value to the ryots. K. R. R.

Bhimavaram. A novel kind of exhibition depicting agriculture, cottage industries, and cattle was held from 23rd Febuary to 26th Febuary 1941 for the 1st time at Bhimavaram (West Godavary District) in connection with *Mahasivarathri* festival under the auspices of the local "Crop Loan and Sale Society". Sri. D. Subbaraya Sastri, Revenue Divisional Officer acted as patron and Sri. T. Krishnamurthy, President, District Board accepted the presidentship of the exhibition Committee. This created a feeling of healthy competition among the people of the district in general and of the town of Bhimavaram in particular in trying to excel one another in adopting improvements in all aspects of village life. The exhibition was also open to all the schools in the taluk. The exhibition was divided into 12 sections as detailed below.

1. *The Agricultural section.* This consisted of seeds and crops, implements and green manure seeds, received from the Agricultural Research Station, Maruteru, Agricultural Demonstrators, Tanuku and Bhimavaram and from the ryots of the District.

2. *Fruit and vegetable section,* Different varieties of fruits and vegetables obtained from the Agricultural Depot and garden, Bhimavaram, Prabhu Nursery, and from ryots.

3. *Flower and foliage plant section,* Collections from Prabhu Nursery and from the depot and garden were exhibited.

4. *Industrial section.* (Products from fruits and seeds) Cholam malt, malt biscuits, fruit preserves and buttons manufactured from seed nuts, were among the exhibits provided by the local demonstrator and his family.

5. *Rice marketing section.* Graded 'Ag mark' rice by the marketing recorder and samples of different varieties of graded rice were collected from the local rice mills.

6. *Cottage industries section.* Articles manufactured by school boys and girls of the taluk and by the local ryots and the commercial organisations, buttons manufactured by Sri Krishna Asram, Guntur and brushes manufactured by Sri K. Chellareddy, messenger, office of the Agricultural Demonrtrator, Bhimavaram, trained under the demonstrator in the art were exhibited.

7. *Bee-keeping section.* Bee-keeping exhibits supplied by Sri V. Tirumal Rao, Entomology Assistant, Samalkot, and the honey samples exhibited by the Agricultural Demonstrator, Tanuku and by ryots of four villages.

8. *Entomological and Mycological sections.* Attractive coloured pictures, photographs and word posters dealing with crop and vegetable pests and diseases with control measures formed the chief feature of these sections.

9. *Gardening section.* Gardens *in situ* belonging to private individuals were inspected by a committee of judges.

10. *Veterinary section.* Pure Ongole, and Mysore breed working cattle *Kapila govu* and good breeding bulls belonging to private ryots were exhibited. Photographs of various breeds of cattle in India were also exhibited. Among the birds exhibited, a country hen which lay two eggs per day attracted the attention of all the visitors.

11. *Health section.* Posters dealing with health were exhibited by this department.

12. *A. I. C. C. Khaddar section.* This branch exhibited the different varieties of Khaddar which commanded good sales during the exhibition.

The exhibition was opened on 23—2—41 by Sri G. Sitaramasastry Garu of Vinaya Ashramam, Guntur. In the presidential address Sri. Rao Saheb G. Jogiraju Pantulu Garu, Retired Assistant Director of Agriculture, pointed out that Government servants should take interest in agriculture and industrial research in addition to their departmental work. He paid a tribute to the All India Cottage Industries Association at Wardha for the useful and substantial work turned out by them. He said that there should be more model farms and exhibitions in different places and industrial centres should be organised to manufacture finished articles from raw products.

Lectures were arranged daily in the evenings on the following subjects :—

1. Village improvement. 2. co-operation. 3. industries. 4. adult education. 5. agriculture and gardening and 6. libraries.

Lantern shows also were arranged during nights. The committee of judges appointed examined the various exhibits, cattle and the gardens, and awarded certificates of merit to the best exhibits. The certificates were given away by Sri. K. V. Narasimha Rao Garu, Tahsildar, and Vice President, Exhibition Committee.

Nearly 15,000 people attended the exhibition and many returned home with the idea that they should win the 1st prize in the next exhibition.

It will be interesting to note that certificates of merit were presented to the following who are connected with the department:—

1. The Agricultural Research Station, Maruteru for pure and improved strains of paddy. 2. The Agri-Demonstrator Tanuku for the best honey. 3. The Store-Keeper Mr. E. Bhadrachalam, Demonstrator's Office, Bhimavaram for his agricultural drawings. 4. The messenger K. Chellareddy, Demonstrator's Office, Bhimavaram for the manufacture of brushes. 5. Mrs. Ramalakshmi (wife of Sri. T. Lakshmipathi Rao, Agricultural Demonstrator, Bhimavaram) for cholam malt and malt biscuits. and 6, Miss Sudarsani (daughter of Sri. T. Lakshmipathi Rao, Agricultural Demonstrator) for fruit preserves.

The exhibition though organised for the first time in this place was very successful. The hearty co-operation of Sri. Y. G. Krishna Rao, Deputy Director of Agriculture, Cocanada and Sri. S. Sitarama Patrudu, Assistant Director of Agriculture, Rajahmundry Dr. P. S. N. Sarma, the President and Sri. N. Gunneswara Rao, B.A., B.L., Secretary and Sri. K. Narasimha Raju, Assistant Panchayat Officer are gratefully acknowledged. T. L. R.

Kadiri. An Agricultural Exhibition was held during the local Brahmotsavam festival of Sri. Lakshmi Narasimha Swami at Kadiri from 14th to 20th March 1941. It attracted a number of visitors from neighbouring taluks, States and Districts. About fifteen thousand visitors mostly ryots visited the exhibition. Important strains of paddy, groundnut, gingelly, and castor and specimen crops of sunnhemp, jonna, ragi and sugar-cane were exhibited. Improved implements for tillage and interculture and insecticides for the control of crop pests and diseases were exhibited. A groundnut decorticator worked by the hand was one of the attractions. Illustrated posters in the local language were utilised to explain the exhibits. M. K.

Putuainipeta. An Agricultural Exhibition was held during the Annual local Harvest festival at Putuainipeta, Pulivendhla taluk on the 14th and 15th March 1941. The exhibition attracted about 3000 visitors from the neighbouring villages, who evinced keen interest by visiting the stall and demonstrations. Paddy varieties, dry land and garden land, cholam and other millets, cotton strains with combed specimens, seeds of green manure crops and oil cakes and other manures were among the exhibits. Interesting pictorial and word posters in the local language and improved ploughs and implements both for tillage and interculturing were most prominently exhibited. Horticultural implements. Bee-keeping appliances and chemicals used in the control of plant pests and diseases attracted large crowds. Model manure heap and pit were also exhibited.

S. V.

Kumbakonam. An Agricultural Exhibition in connection with the Masi Maham festival at Kumbakonam was held in cooperation with the Health Department of the Municipality and Sri. Lakshmivaraha Iyengar, the Managing Director of the South Indian Nursery at a centarally situated site near the Mahamaham tank for 6 days from 10th to 15th March 1941. The Exhibition though not very large was neatly got up and was very attractive.

Particularly from 10th to 13th the crowd was very considerable, on account of the Maham festival proper on the 12th on which date alone, the visitors to the Exhibition would have numbered 3500.

It is estimated more than 8000 people visited the exhibition during the period it was kept open. In our departmental exhibition, the different strains of paddy, oil seeds, sugarcane, green manure seeds, samples of cotton and ragi strains, plantain bunches of different varieties, bee keeping appliances, spraying and dusting appliances a large range of improved implements including ploughs, Settun, green manure trampler etc., live specimens of green manure, fodder grasses and English vegetables were all on show. In addition to explaining the significance of the several exhibits to the visitors, they were given information on various agricultural improvements that they could profitably adopt.

The Municipal Commissioner, Kumbakonam and Sri. Lakshmivaraha Ayyangar, the organiser of the Exhibition took great interest in and helped materially to make the exhibion a success. M. A.

Samalkot. *The District work and Farm subordinates' Conference, at the Agricultural Research Station, Samalkota.* This was conducted by Sri. Sitarama Patrudu Garu, Asst. Director of Agriculture, Rajahmundry and Sri. Y. G. Krishna Rao Naidu Garu, Deputy Director of Agriculture, I circle, Cocanada, from 30—1—41 to 6—2—41. The Director of Agriculture attended the Conference from 2nd to 5th February. He exhorted the members assembled to secure close co-operation of the Revenue and other departments in the spread of the agricultural improvements; to properly record statistics of improvements and plot the same as graphs to visualise progress. The Director of Agriculture also elicited the experiences of those assembled, in regard to the kind of training that is to be given to a recruit before he is sent out as a demonstrator, for work in the districts. The Asst. Director of Agriculture, reviewed the work (1) crop by crop in the form of symposia embracing all aspects of every important crop of the Godavary Division, (2) under improved ploughs (3) under improved Sindevahe furnaces and (4) under Good Farmers' Associations pronounced to be the keystone, for a new orientation in the methods of propaganda, for the rapid spread of Agricultural improvements. Talks were given in Telugu by the subordinate staff, on bee-keeping, sunn-hemp culture and fibre production and folk songs for propagandistic ends. The Director visited the farm museum, inspected the work on the farm and the development in the evolution of new types of paddy, the testing of new types under sugarcane, the sunn-hemp fibre studies etc. The Director inspected the areas under improved cane and the improved Sindewahe furnaces with earthenware chimneys and the work of the Sugarcane Growers' Co-operative Union at Kirlampudi, bee-keeping run as a cottage industry at Santhi Ashramam, Thotapalle hills; the scheme area for the reclamation of saline lands, in the Cocanada taluq: the Good Farmers' Associations at Medapadu and Biccavole and the canning industry at Kadiam.

The Conference of Crop Specialists and the District Officers at the Agricultural Research Station, Samalkota. The Conference was got up at the instance of Sri. S. S. Patrudu Garu, Asst. Director of Agriculture, Rajahmundry and lasted six days. The Senior Assistant in-charge of the Maruteru Agricultural Research Station, the Assistant on Chillies' Survey from Guntur, the Farm Manager, Samalkota, the Assistant Marketing Officer, Madras, the Superintendent, Agricultural Research Station, Anakapalle, the Assistant Directors of Agriculture, Vizagapatam, Guntur and Rajahmundry, the Deputy Director of Agriculture, I Circle, Cocanada, the Paddy Specialist and the second Cane Breeding Officer partook in discussions on the programme of research work for the Circle and the Stations of the Circle. Taking cognizance of past work, the cropping scheme of every agricultural station of the Circle was gone into, bearing in mind the problems of the districts the Station is intended to serve. The discussions on the programmes were thorough and searching.

Sri, K. Bhushanam, B. Sc., Ag., of the Agricultural Research Station, Samalkota, left for a month's training for Bilari. Moradabad Dt., U. P. in *gur* and sugar manufacture, in the open system and the Bels system. The present time is an opportune one to develop this cottage industry, with the wide margin prevailing between the rates of sugar and jaggery. M. S. N.

Tiruchendur. The annual cattle fair was held at Tiruchendur, Tinnevelly district on the occasion of the Masi Maham festival. This is a famous pilgrim centre where large crowds gather. About 8,000 heads of cattle assembled and most of them were of the local type. A few animals from Mysore side also were brought for sale. Taking advantage of this an Agricultural Exhibition was conducted from the 7th to 22nd of March 1941. Various improved implements and seeds were exhibited. Demonstrations of improved mhote wheels and other implements were done. Control measures against pest and diseases were demonstrated. Proper methods of bee keeping were shown and economic methods of making palmyra jaggery on a large scale were explained. Two magic lantern lectures were delivered on agricultural subjects. R. C.

Vridhachalam. An Agricultural Exhibition was held at Vridhachalam during the local *Masi Magam* festival from the 7th to 13th March 1941. The President, Panchayat Board kindly permitted the erection of a stall in front of the entrance to the temple adjoining the Public Radio ground. It attracted more than 12,000 visitors from the rural areas of the neighbouring taluks. Paddy and rice samples of improved strains of Aduturai and Palur Agricultural Research Stations, sugarcane varieties, fodder grasses from Palur, specimens of oil seeds collections from the Agricultural Research Station, Tindivanam and bonemeal samples kindly sent by Messrs. Rodrigues & Co., Kadambur were exhibited. The samples were arranged tastefully and were supplemented by pictorial and word posters. Samples of cream jaggery and cream sugar, graded eggs from Palur Farm, appliances and chemicals used in the control of pests and diseases were also among the exhibits. Two lantern lectures and several ordinary lectures were delivered by the local Demonstrator.

A variety of improved agricultural implements was also exhibited neatly outside the main stall on the Radio ground. Malt making demonstration was conducted on 2 days and the dietetic value of malt was explained to the visitors.

P. V. H.

College News and Notes.

Students' Corner. The students were busy with their examinations during the first three weeks of the month and the college was closed on the 24th instant.

Honey Week. The annual "Honey Week" was inaugurated this year by A. R. C. Westlake Esq., I. C. S., Collector of Coimbatore on 29—3—41 at 5 p. m., in the premises of the Insectary before a distinguished gathering. An exhibition pertaining to bee-keeping was arranged and kept open to the public from the 29th March to the 4th April.

St. John's Ambulance Brigade. A First Aid training class including officers and students was started on the Agricultultural College Estate by the combined efforts of the Principal and Sri. S. E. Narayana Ayyar, Secretary, Red Cross Society. Dr. P. R. Kuppuswamy was in charge of the training. The class started in January 1941 and completed in March, with two classes a week. Examinations were held on 28th and 29th. Forty-three candidates appeared and all passed. A division of St. John's Ambulance Crops consisting of the residents of the Estate is being formed.

Crore Day Celebration. The Crore Day was celebrated on the Agricultural College Estate on the 5th instant, the main feature being the feeding of the

poor. Over 100 poor people drawn from the surrounding area were sumptuously fed, the expenses being borne by Rao Bahadur Sri. G. N. Rangaswami Ayyangar Principal, Agricultural College, Coimbatore.

Hostel Dinner. The Annual 'Moon-light' Dinner arranged by the students took place on the spacious Threshing floors of the Central Farm on the 14th. of last month. A good number of officers responded to the invitation of the Secretary, Hostel Committee. The officers spent a delightful hour with the Students. With the distribution of 'Pan-su-pari' the function came to a close.

Visitors Mr. Hafizuddin Chowdhury, M. L. A. (Bengal) and Mr. J. N. Sen Gupta, M. B. E. Secretary of the Bengal Industrial Survey Committee visited the Research institute and the Imperial Sugarcane station on the 13th and 14th in order to study the sugarcane cultivation in these parts.

Sri. M. R. V. Panikkar, Principal. Madras Veterinary College and Sri. B. Narasimha Iyengar, Director of Agriculture, Mysore (Retd), visited the College in connection with the B. Sc. Ag. examinations.

Mr. R. W. Littlewood, Livestock Development Officer was on a short visit to the estate between the 7th and 9th April.

Weather Review—MARCH 1941.

RAINFALL DATA

Division	Station.	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·2	−0·4	0·2
	Calingapatam	0·0	−0·4	0·4
	Vizagapatam	1·2	+0·9	2·7
	Anakapalli*	0·7	0·0	2·9
	Samalkota*			
	Maruteru*	0·0	−0·6	0·2
	Cocanada	0·3	−0·2	1·7
	Masulipatam	0·0	−0·3	0·1
	Guntur*	0·0	−0·4	0·1
Ceded Dists.	Kurnool	0·0	−0·3	0·1
	Nandyal*	0·0	0·2	0·6
	Hagari*	0·0	−0·2	0·2
	Siruguppa*	0·0	−0·3	2·4
	Bellary	0·0	−0·2	0·7
	Anantapur	0·0	−0·2	0·8
	Rentachintala	0·0		0·5
	Cuddapah	0·0	−0·2	0 8
	Anantharaju-pet*	0·0	−0·6	1·1
Carnatic	Nellore	0·0	−0·2	0·2
	Madras	0·0	−0·2	0·7
	Palur*	0·0	−1·8	2·7
	Tindivanam*	0·0	−1·4	1·3
	Cuddalore	0·0	−0·2	4·3
Central	Vellore	0·0	−0·2	0·5
	Gudiyattam*	0·0	−0·4	0·6
	Salem	0·0	−0·5	0·1
	Coimbatore	0·0	−0·5	0·8
	Coimbatore A. C. & R. I.*	0·0	−1·6	1·4
	Trichinopoly	0·0	−0·4	0·2

Division	Station	Actual for month	Departure from normal @	Total since 1st Janaruy
South	Negapatam	0·0	−0·3	3·8
	Aduthurai*	0 0	−1·3	1·7
	Madura	0·0	−0·5	1·4
	Pamban	1·3	+0·8	7 3
	Koilpatti*	0·0	−0·9	1·7
	Palamkottah	0·0	−1·0	1·4
West Coast	Trivandrum	2·2	0·0	2·7
	Cochin	0·3	−1·7	2·0
	Calicut	0·0	−0·5	0·6
	Pattambi*	0·0	−0 9	0·0
	Taliparamba*	0·1	−0·1	0·1
	Kasargode*	0·0	−0·6	0·0
	Nileshwar*	0·0	−0·3	0·2
	Mangalore	0·0	−0·1	0·0
Mysore and Coorg	Chitaldrug	0·0	−0·3	0·2
	Bangalore	0·0	−0·5	0·2
	Mysore	0·0	−0·3	0·1
	Mercara	0·2	−0·4	0·2
Hills	Kodaikanal	0·0	−2·0	4·5
	Coonoor			
	Ootacamund*	0·0	−0·5	1·3
	Nanjanad*	0·1	−0·9	1·0

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated up to 1937 (published in Fort St. George Gazette).

Weather Review for March 1941.

Weather was generally dry over the presidency except for scattered thunder showers in the Circars, on the West coast and hills.

Temperatures were generally slightly above normal especially in the Ceded Districts.

Weather Report for the Agricultural College and Research Institute Observatory.

Report No. 3/41.

Absolute maximum in shade.	...	99·5°F
Absolute minimum in shade.	...	62·8°F
Mean maximum in shade.	...	95·7°F
Departure from normal.	...	0·9°F
Mean minimum in shade.	...	69·2°F
Departure from normal.	...	−0·5°F
Total rainfall for the month.	...	nil
Departure from normal.	...	−0·81
Heaviest fall in 24 hours.	...	nil.
Total number of rainy days.	...	nil.
Mean daily wind velocity.	...	1·03 m. p. h.
Departure from normal.	...	−1·64 „
Mean humidity at 8 hours	...	69·1%
Departure from normal.	...	−0·6%

Summary. Dry weather prevailed duriug the month. The day temperatures were slightly above normal while the nights were slightly below normal. The humidity was normal while the movement of the wind was below normal.

P. V. R. & S. V. K.

Departmental Notifications.

Gazetted Services

1. Appointments.

Sri. K. Venkatarama Ayyar, Permanent Assistant Director of Agriculture in category 5, class 1, Madras Agricultural service and officiating Superintendent, Agricultural Research Station, Anakapalle, in category 7, class 1, Madras Agricultural Service, to be District Agricultural Officer, Cuddalore.

Sri. T. G. Anantarama Ayyar, permanent Upper Subordinate II Grade, in the Madras Agricultural Subordinate service is appointed to officiate as District Agricultural Officer, in category 5, class 1, Madras Agricultural service and is posted to Trichinopoly.

Sri. R. Vasudeva Rao Nayudu, permanent upper subordinate, Agricultural section on foreign service, as Secretary to Tobacco Market Committee, Guntur is reverted to British service and is appointed to officiate as Superintendent Agricultural Research Station, Anakapalle, in category 7, class I Madras Agricultural service *vice* Sri. K. Venkatarama Ayyar, posted as District Agricultural Officer, Cuddalore.

2. Transfers.

Name of officers.	From	To
Sri. B. Ramayya,	Dy. D. A., Cuddapah,	Dy. D. A., Coimbatore.
„ C. Ramaswami Nayudu,	Offg. Dy. D A., Coimbatore,	J. L. A. & Asst. Supdt., C. F., Coimbatore.

Sri M. Kantiraj Nayudu,	J. L. A. & Asst. Supdt., C. F., Coimbatore,	D. A. O., Chittoor.
" S. Sitarama Patrudu,	Asst. D. A., Rajamundry,	D. A. O, Cocanada.
" P. Subrahmaniam,	Asst. D. A., St. Thomas Mount,	D. A. O., Saidapet.
" M. Anandan,	Asst. D. A., Cuddalore,	D. A. O., Tanjore.
" R. Chokkalingam Pillai,	Asst. D. A., Tinnevelly,	D. A. O., Salem.
" K. Avudainayakam Pillai,	Asst. D. A., Coimbatore,	D. A. O., Ramnad Dt.
" M. U. Vellodi,	Asst. D. A., Tellicherry,	D. A. O., Coimbatore.
" U. Vittal Rao,	Asst. D. A., Pattukottai,	D. A. O., Mangalore.
" A. Ramaswami Ayyar,	Asst. D. A., Tirupattur,	D. A. O., Vellore.
" P. Abbishekanatham Pillai,	Curator, Govt. Bot. Garden & Park, Ootacamund,	Curator, Govt. Bot. Garden, & Park, and D. A. O, Nilgiris.
" Samuel Jobitha Raj,	Asst. D. A., Madura,	D. A. O., Calicut.
" A. Gopalan Nayar,	(on leave),	D. A. O., Tinnevelly.
" L. Narasimhacharya,	A. D., Chittoor,	D. A. O., Masulipatam.
" V. N. Subbanna Acharya	Upper Subordinate, Agri. Section,	D. A. O., Anantapur.

Subordinate services.

Appointment.

Sri. T. R. Narayanan, Permanent Assistant, Millets Section, Coimbatore, is appointed as Temporary Assistant in Plant Physiology in the Dry Farming Research Scheme, Hagari with effect from the date of joining.

Transfers.

Name of Officers.	From	To
Mr. N. K. Thomas,	A. D. Calicut	F. M., C. F. Coimbatore.
Sri. S. Krishnamurthi	F. M., C. F. Coimbatore,	F. M. D. F. S., Hagari.
" K. G. S. Bhandari,	A. D., Mangalore,	A. D, Koondapur.
" K. Tejappa Shetty,	A. D., Coondapur,	A. D., Kalyandrug.
" K. C. Thomas,	A. D., Coimbatore,	F. M. A. R S., Nandyal.
" A. Raghavan,	F. M. A. R. S., Nandyal,	Asst. in Cotton, Cocanada Cotton Scheme, Narasaraopet.
" N. Srinivasa Rao,	A. D., Salem,	A. D., Kollegal.
" U. L. Srinivasa Rao,	A. D., Kollegal.	A. D., Dharampuri.
" K. Meenakshi-sundaram,	A. D., Dharampuri,	F, M. D. F. S., Hagari.
" M. A. Balakrishna Ayyar,	A. D., Vellore,	A. D, Wallajah.
" L. Sankarakumara Pillai,	A. D., Wallajah,	A. D. Nanguneri.
" S. Ramachandran,	A. D., Tinnevelly,	A. D., Koilpatti.
" M. Kandaswami,	A. D. Koilpatti,	Asst. in cotton section, Coimbatore.
" S. V. Ramachandran,	A. D. Sattur,	A. D., Tenkasi.
" A. Krishnaswami Ayyar,	A. D, Madura,	A. D., Thirumangalam.

Sri K. Sanjiva Shetty,	Teaching Asst. in Agriculture, Coimbatore,	A. D., Kudligi.
„ S. Muthuswami.	A. D., Thirumangalam,	F. M. A. R. S., Siruguppa.
„ C. Hanumantha Rao,	F. M. A. R. S., Siruguppa,	F. M. A. R. S., Anakapalle.
„ S. Kuppuswami Ayyangar,	A. D., Trichinopoly,	A. D., Kulitalai.
„ N. Subramania Ayyar,	A. D., Kulitalai,	A. D., Ambasamudram.
„ K. Kuppamuthu,	A. D., Cuddalore,	A. D., Villupuram.
„ E. N. Rangaswami Ayyangar,	Asst. A. D., Villupuram,	Asst. A. D., Kanigiri.
„ K. Varada Acharya,	A. D., Saidapet,	A. D. Gooty.
„ J. Gopala Rao,	A. D., Nellore,	F. M. F. R. S., Koduru.
„ Y. Venkataswami,	A. D., Anantapur,	F. M. A. R. S. Samalkota.
„ K. Rama Rao,	A. D., Bellary,	A. D., Rayadrug.
„ K. Jagannatha Rao,	A. D., Cuddapah,	A. D. Jammalamadugu.
„ A. Venkobachari.	Asst. A. D., Jammalamadugu,	Asst. A. D., Harpanahalli.
„ S. Varadarajulu Nayudu,	A. D., Kurnool,	A. D., Dhone.
„ N. Ranganathachari,	A. D., Dhone,	A. D., Pattikonda.
„ M. Narasimham,	A. D., Guntur,	A. D., Tenali.
„ S. V. Doraiswami Ayyar,	F. M.,C. F., Coimbatore,	Teaching Asst. in Agri., Coimbatore.
„ G. Kameswara Rao.	A. D., Ongole,	F. M., A. R. S., Guntur.
„ P. Ramanatha Rao,	A. D., Masulipatam,	A. D., Nuzvid.
„ A. Rammohan Rao.	A. D., Ellore,	A, D., Ellavaram.
„ P. Lakshminarayana,	A. D., Cocanada,	A. D., Chodavaram.
„ M. J. David,	A. D., Mayavaram,	Asst. in Soil Physics D. F. .S, Hagari.
„ T. Devasikkamani,	A. D., Proddatur,	A. D., Jammalmadugu,
„ T. V. Srinivasa Acharlu,	A. D., Ambasamudram,	A. D., Hadagalli.
„ D. Viswanatha Reddy,	A. R. S., Anakapalli,	A. D., Prodattur (under training).
„ N. Ramadoss Pantulu,	A. D., Tenali,	A. D., Ongole.
„ V. Ratnaji Rao,	A. D., (on leave),	A. D., Sullurpet.
„ V. Satagopa Ayyangar,	Secy., Groundnut Market Committee, Cuddalore,	A. D., Mayavaram.
„ A. M. Muthayya Nattar,	Supdt., Groundnut Market Committee, Cuddalore,	A. D., Pattukottai.
Janab Shaik Hussain, Sahib	A. D. Working in the Scheme of Dry Farming Experiments in Red Soil area,	A. D., Sidhout.
Sri A. Shanmugasundaram Pillai,	A. D., Pattukottai,	F. M., Pattukottai.
„ K. R. Nagarajan,	F. M., Pattukottai,	Fieldman, A. R. S. Palur.

Leave.

Name of officers.	Period of leave.
Sri. G. Narasimhamurthi, F. M., A. R. S., Siruguppa,	L. a. p. for 30 days from 16-4-41.
„ E. Achuthan Nair, Asst., A. D. (on leave).	Extension of l. a. p. for 2 months with m. c. from 19-4-41.

Sri S. Venkatarama Ayyar, A. D., Sriperambudur.	L. a. p. on m. c. for 3 months from the date of relief.
„ K. Srinivasan, A. D., Kalladakurichi,	L. a. p. for 1 month from 10—5—41.
„ V. Venkatadri Reddy, Nursery F. M., (on leave).	Extension of l. a. p. on m. c. for 5 months and 29 days from 18-3-41.
„ B. N. Padmanaba Ayyar, A. D., Gingee.	Extension of l. a. p. on m. c. for 2 months from 1-5-41
„ M. Gopala Unnithan, A. D., Tirupathur.	L. a. p. for 1 month from 16-4-41.
„ S. Krishnamurthi, F. M. D. F. S., Hagari.	L. a. p. for 2 months from the date of relief.
„ C. S. Sankaranarayana Ayyar, A. D., Hosur.	L. a. p. for 1 month from 21-4-41.
„ T. S. Ramakrishnan, Asst. in Mycology, Coimbatore.	L. a. p. for 1 month and 15 days from 5—5—41.
„ D. Shanmugasundaram Pillai, A. D., Aruppukottai.	L. a. p. for 1 month from 1—5—41.
„ K. Raghunatha Reddy, Agri. Marketing Asst., Madras.	L. a. p. for 31 days from 1—5—41.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during the quarter ending 31—3—1941.

A. Books.

1 *Anthropology and Agriculture: Selected References.* Mac Leish, K. and Hennefrund, H. E. (1940). 2. *Experience in Practical Agriculture (Tamil).* Nanjappa Gouder, C. V. (1941). 3. *Our India.* Minoo Masani. (1940). 4 *Repairing Farm Machinery.* Morrison, I. G. (1940). 5. *Principles of Gully Erosion in the Piedmont of South Carolina* Ireland, H. A. *et al* (1939). 6. *Landslides and Related Phenomena: A Study of Mass-movements of Soil and Rock.* Sharpe, C. F. S. (1938). 7. *Manures and Manuring.* Garner, H. V. (1940). 8. *Princibles and Practices of Crop Production in India:* Dutt, C. P. & Pugh, P. M. (1940). 9. *Arable Crops of the Farm.* Bond, J. R. (1940). 10. *Sugarcane and Its Culture.* Kerr, H. W. & Bell, A. F. (1939). 11. *Tobacco Production and Consumption in India and Burma.* Gibbs, J. B (1939). 12. *Report on the Marketing of Potatoes in India and Burma (Agricultural Marketing Service 22).* (1941). 13. *The Biological Campaign Against Prickly Pear.* Dodd, A. P. (1940). 14. *The Biology and Control of Wireworms: Review of Literature.* Thomas, C. A. (1940). 15. *Further Studies on Cereal Rusts in India.* Metha, K. C. (1940). 16. *Hand book of Phytopathogenic Viruses.* Holmes, F. O. (1939). 17. *Cooperative Farming.* Dey, S. K. (1940). 18. *Indian Indigenous Milk Products.* Davies, W. L. (1940). 19. *Mineral Metabolism.* Shoal, A. T. (1939), 20. *Vitamin E: A Symposium.* Bacharach, A. I. & Drummand, J. C. (1939). 21. *Protein Metabolism in the Plant.* Chibnall, A. C. (1939). 22. *Physico-chemical Methods 3rd Edition Rev.* Reilloy, J. & Rao, W. N. (1940). 23. *Text Book of Zoology Vol. II.* Parker, T. J. & Haswell, W. A. (1940). 24. *Thorpe's Dictionary of Applied Chemistry 4th Edition Rev. Vol. 4 Digallic Acid. Feeding Stuff.* Thorpe, J. F. & Whiteley, M. A. (1940). 25. *Indian Economics Vol. II.* Juthar, G. B. & Beri, S. G. (1937).

B. Administration Reports of Agricultural Departments

1. Reports of Subordinate Officers of the Department of Agriculture, Madras, for 1939-40. 2. Detailed Report of the Agricultural Chemist, Entomologist and Mycologist of the Department of Agriculture, Madras for 1939-40. 3. Annual Report of the Imperial Council of Agricultural Research—India. 1939-40. 4. Bihar Agricultural Department—Annual Report. 1938-39. 5. Annual Report of the Royal Botanic Gardens, Calcutta for 1939-40. 6. Cochin State Agriculture Department—Administration Report for 1939-40. 7. Punjab Irrigation Research Institute—Annual Report for 1938-39. 8. Ceylon Agri. Dept. Administration Report for 1939. 9. Report of the Minister of Agriculture for the Dominion of Canada for 1939-40. 10. Amani Agricultural Research Station—Annual Report for 1939. 11. Arkansas Agricultural Experiment Station. 1939-40. 12. Jamaica Agricultural Department Annual Report for 1939-40. 13. Colorado Agricultural Experiment Station. 1939-40. 14. New York Agri. Experiment Station. 1939-40. 15. Pennsylvania Agricultural Expt. Station. 1939-40. 16. Puerto Rico Agricultural Experiment Station. 1939.

HOSTEL TATLER

CONTENTS

Students of the Agricultural College, Coimbatore 1940—41.
(Photograph taken on the occasion of farewell party to Mr. R. C. Broadfoot).

To My Alma Mater.

"This fond attachment to the well-known place,
Whence first we started our life's long race,
Maintains its hold with such unfailing sway
We feel it even in age, and at our latest day" (*Cowper*)

Hail my *Alma Mater*
And of thousands more,
Earlier, now, and later
Nurtured on thy lore
Of mighty thoughts and words that aye to heaven soar.

Withered form and weakness
Mothers reach through pain;
Till in mortal meekness,
Mid our wailing vain,
They breath their spirits forth and turn to dust again.

But though, youthful ever
Art not suckling-worm;
Time and care can never
Taint the heaven-born;
Thy strength is more and more and fresh as in the morn.

Oracle of learning
That hast ever been,
To thy alter burning
With a sacred sheen,
I came to sacrifice with deep-devotest mien

Thro' wearing distance
From the northmost land,
Seeking thy assistance
I came and joined thy many-raced band.

Deep we drank the honey
Like the humming bee;
Like swallows, lands more sunny
Seeking, such were we;
High and higher soared we, as larks above the lea.

Thus I passed in gladness
A score of months and more,
In the ecstatic madness
Of amazing lore
No cares I felt nor langour, but joy for ever-more.

Like a favoured maiden
    From her parents' care,
Passing sorrow-laden,
    With no help or rare,
To her husband's lordly roof. new joys and woes to bear.

Like a rich bark sailing
    From her haven-home,
With a heart not failing
    Nor secure, to roam
In quest of gain or fame, upon the dangerous foam.

Now I leave thy altar
    And thy prophets kind;
May I never falter,
    Ever may the mind
Which thou hast formed and stored, now boldly brave
life's wind!

Bless me, noble mother,
    Ere I from thee move;
For as that dear other
    Whom I love above
Adore for gift of life, so truly I thee love.

Many a foot more worthy
    Thy great halls may pace;
Many a name more worthy
    May thy records grace;
In loyal love of thee I yield to none first place.

Hail my *Alma Mater*
    And of thousands more,
Earlier, now, and later
    Nurtured on thy lore
In mighty thoughts and words, grow thou for ever more!

(N. S. V.)

The Tatler's Diary 1940—41.

1940.

June 15. The college re-opens.

" 16. Some students begin their studies, saying that University examinations are fast approaching.

" 20. Ramasub arrives after his summer slumbers.

" 25. The date of election announced by the Vice-President.

" 27. The day of election. There is not much pestering by candidates as on previous occasions. Co-operation is evidenced among the students by nearly all the candidates being elected unanimously.

July 2. The first year students arrive.

" 13. College Day Sports. Mrs. K. M. Unnithan distributes the prizes.

" 15. College Day and Conference opened by the President, Mr. S. V. Ramamurthy, M. A., I. C. S. The prize-winners receive their prizes. Mr. G. Rama Rao bags four prizes open to 2nd year students amidst great applause.

" 16. Entertainment.

" 17. The College-Day comes to a close.

" 18. Mr. A. R. C. Westlake, Director of Agriculture delivers the Inaugural Address of the Students' Club.

" 25. A happy coincidence. Mr. Ramana Rao buys a cycle from Mr. Ramalingam for a modest price of Rs. 5 preferentially given to him by Mr. Ramalingam rejecting a more handsome offer from the buyers of scrap iron. Mr. S. V. Sreenivasan buys a Tomco washing soap saying to bystanders 'Live Labour, Die Dignity'.

" 27. Some students start on a literacy campaign. Ramasub is busy arranging for their conveniences. They arrive back and find that it is not worth the trouble after spending each one rupee.

August 1. Mr. Achutharama Raju resigns his mess representativeship.

" 5. A debate was held under the auspices of the Students' Club on the subject "Whether girls can be admitted into our College".

" 19. An emergent General-body meeting of the Students' Club was held to pass a resolution "That sincere and heartfelt wishes be offered to Mr. R. C. Broadfoot our beloved Principal for a successful operation, a speedy and complete recovery and a safe return to the College to resume the office of the Principal and to guide the destinies of the students of the College whom he has treated with

consideration, sympathy and affection". Mr. Broadfoot leaves for Madras and all the students assemble at the station to see him off.

„ 30. Sri N. Subramania Iyer talks on "Co-operation and Agriculture" under the auspices of the Students' Club.

Sep. 3. Second year of War begins.

„ 5. All the students are busy with their books for the September examination.

„ 6. Ramasub finds no time to spare for books, as he is busy preparing himself and his kit for the tour which begins on October 1st.

„ 11. Examinations begin.

„ 13. Third year students go home for Michaelmas.

October 1. Third year students start on tour headed by Sri. Unnikrishna Menon, Senior Lecturer in Agriculture and Sri. T. Nataraj, Asst. Lecturer in Agriculture. Rao Bahadur G. N. Rangaswami Ayyangar, Principal and Sri. P. A. Venkateswaran, Warden go to the station to see them off.

„ 2. After a pleasant journey, Mr. Ramana Rao opines that it will be more enjoyable, if we had also a Chemical tour at the end of this Agricultural tour.

„ 3. Mr. Vasudeva Rao, S. V. Sreenivasan and C. V. Ramanamurthy joined the party at Gudiyatham station when the party was leaving for Kodur.

„ 8. Mr. Raju marches to Hagari station. His sandals get a happy burial in the slushy black-cotton soil after faithful service for 8 years and were heard to say just before they sank into the mire "Thank God! we have escaped a tyrant and a hard task master."

„ 9. H. E. the Governor of Madras visits the College.

„ 10. Third year students are busy in a Bellary choultry.

„ 12. While Ramasub and Venkataramanamurthy were walking in Cubbon park at Bangalore after a delightful tea, some film fans mistook them for Laurel and Hardy come on a visit to India.

„ 14. Dr. Ida Scudder, Principal, Women's Medical College, Vellore addressed the students of our College on "The adventure of Vellore Women's Medical College."

„ 15. While all the students interest themselves in knowing about the farm at Hosur, Mr. Somanna gets training in cooking.

„ 16. The third year students return after the tour. The Principal meets them at Podanur Station.

„ 19. Ramasub, Achutharama Raju and Sambamurthy seem to be indisposed.

„ 20. They develop malaria.

Oct. 21. A general body meeting was held to discuss some points with respect to our new Club building.

„ 23. Mr. Narayanamurthy of the final year class observes silence for three hours praying for the happy recovery of the malarial patients.

„ 24. All improve miraculously.

„ 28. Second year students start on their grand tour to Tudialore lasting for 4 hours.
Mr. Basappa is busy. The reflection came to us—poor creatures—probably they may not have any other tour on account of the War.

„ 29. The Hostel experiences a miniature bombing in the explosions of crackers. Mr. G. Ramalingam suggests that civilians should be spared at least in this bombardment and should not be made to run out of their rooms.

„ 30. Deepavali.

Nov. 13. As in previous year the Inter-Collegiate competitions in Hockey, Cricket, Foot-ball and Athletics among Colleges in The Bangalore Zone were held at Coimbatore on the Agricultural College grounds.

Dec. 2. The Bangalore division final Hockey match is played at Bangalore against the Ceded Districts College. Our College unfortunately loses by one goal. Mr. H. Shiva Rau, Vice-President accompanied the party of players to Bangalore.

„ 4. Under the auspices of the Students' Club Sri. N. Krishnaswami Iyengar, B.A., B.L., Sub-Judge, Coimbatore delivered a lecture on "Advice to Students" with Rao Bahadur G. N. Rangaswami Iyengar, the Principal in the chair.

„ 18. Selection Examination.

„ 21. Christmas vacation begins.

1941 Jan. 3. Second year students start on an educational tour to southern Districts.

„ 4. College re-opens after the Christmas and New Year Holidays.

„ 17. Second year students return from their tour.

„ 23. Rao Bahadur T. S. Venkataraman delivered a lecture on "Indian Village and our duty to it".

„ 24. Mr. A. J. Macdonald, B. Sc., B. Sc. (Agri.) N. D. A., Officer in charge, Poultry Research Section, Imperial Veterinary Research Institute, Izatnagar delivered an educative and thought provoking lecture on "Poultry Farming in India" with Sri. K. Unnikrishna Menon in the chair.

Jan. 31. Under the auspices of the Students' Club Sri. N. Lakshmanan delivered a lecture on "Creative joy through dancing.

Feb. 3rd, 4th and 5th. The Maharajah of Travancore Curzon Memorial lectures were delivered by Dr. M. Damodaram on the subject of "Nitrogen metabolism and feeding of plants and stock."

10th. The Annual Essay Competition was held in the Freeman Hall the subject being 'Why India should participate in the War.'

Evening—Elocution Competition was held under the auspices of the Students' Club—the subject being Sir M. Visweswarayya's saying 'Industrialise or perish'.

17th. Inter-tutorial Elocution competition was held.

22nd. Club Day celebrations.

23rd. Students begin serious preparations for the examinations.

The turning point.

Three Precious Years.

IT was three years ago that we, the senior-most batch of students, at present in the hostel, came here. We felt that the place was quite beautiful and healthy and that we could spend the prescribed period of three years as three days. The three years are over even much quicker than three days. As we think about it, we recollect with sweet memories the events of the past three years. We wish that the days should have been longer, as the period spent here is being felt to be too short now, on account of its pleasant and useful nature.

The special feature of this place is the congenial climate. The cool days make us feel happy always and keep us healthy too. The view of the cloud-capped beautiful blue mountains on the north with the rays of the sun illuminating them gives much pleasure to all observers of natural beauty.

The field work which is a special privilege of the students of this College, kept us in good health and spirits all along. Going out early in the morning with a sickle, basket, bag, hoe, *mammotti* and working in the morning sun in company with friends is one of the happiest things for any lover of nature. Let alone the acquisition of knowledge in practical agriculture by such work; we learn much about the oft quoted phrase, 'Dignity of Labour'. The truth of the saying that 'work is pleasure' can never perhaps be more thoroughly verified than by doing some field work. The happiness that we derive by resting awhile after a strenuous spell of work can never be imagined by those working only at the desk.

In addition to the above advantages, we gather much useful knowledge in the different sciences. We feel confident that we are well equipped for the battle of life, in spite of the fact that the science of Agriculture is too complex to be mastered except by long and hard experience.

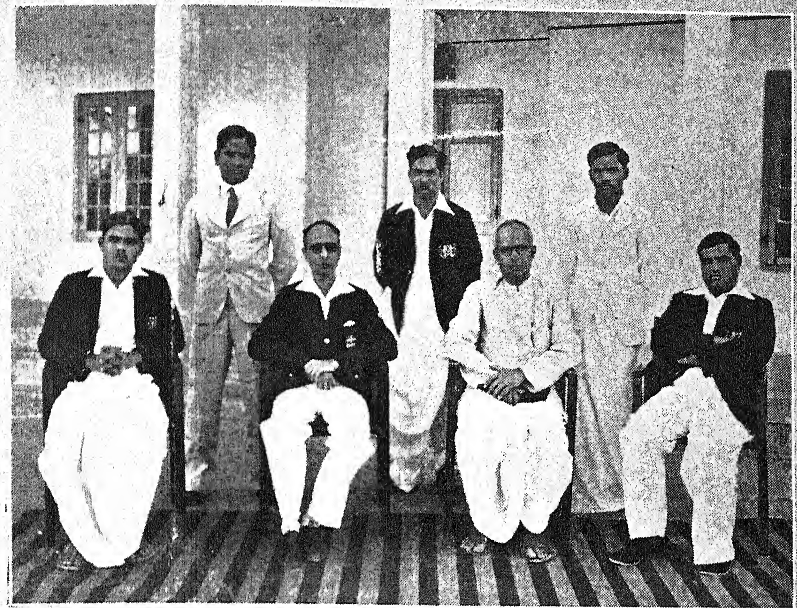
We are here in the company of students and teachers. The hostel consists of students with different languages, customs, manners, religions, tastes, habits and talents. Perhaps nowhere can a sense of tolerance and friendliness be better developed than in hostels of this kind. So far we have been very happy and carefree here on account of the warden and others looking after our welfare and our hearty thanks go to the warden and his staff. We shall be considered to have become experienced enough and shall be expected to hear patiently about what others want of us. The usual reluctance to studiously avoid any thing against our taste has to be gradually given up. The gravity of

responsibility falls upon us. We have to get on in this world hereafter not with the gay light step of the student but with a heavier step and a slower pace.

We are not sure whether we shall be able to renew in person the acquaintances of people residing in different places, when once we leave this College. This is another thought that fills our mind when we think of how it looks when we enter life. The hostel consists of members that come from all parts of the Presidency from almost all the districts. Oh! what a wide representation. The hostel appears better represented than any legislative body. But, fortunately, here not a single problem exists which troubles the outside world so much. There is no minority problem and no communal tension. Perfect equality prevails. All the members have equal rights. The Governor of this small representative body is our Principal. He is not confronted with so many problems as H. E. the Governor of Madras, because big problems never arise in this Province and even if they make their way in, they will be easily settled. The minister for food and welfare, our Warden, is much respected. The Government that prevails is not a crushing autocracy but a benevolent one. Though the authorities have rights of vetoing, the occasion for the use of special powers never arises. We replaced the old members when we came in as freshers and the coming batch soon fills our place. "The old order changeth yielding place to new".

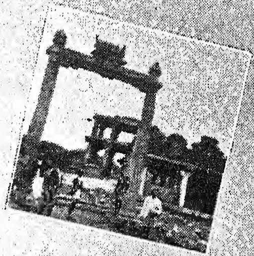
We go out, as we have to, but with a much disturbed heart. The part of life so far led by us is of course the golden age of our lives, as we have been care free and happy all these days. We do not know how well we can face the knotty future and its knottier problems. It is not even the problem of life that confronts us now but the problem of how to harden our hearts and depart from our dear friends and revered teachers in this sacred *Alma mater* of ours. We depart but our attachment grows stronger with the distance that separates us. The events and memories of these three happy years, the men with whom we moved here will ever be green in our hearts and may it help us in future to spend a few happy moments now and then by reminding us of our old days here.

M. E.

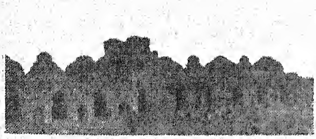


The Men behind the Hostel Tatler.

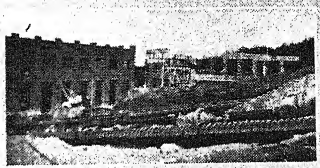
Reflection.



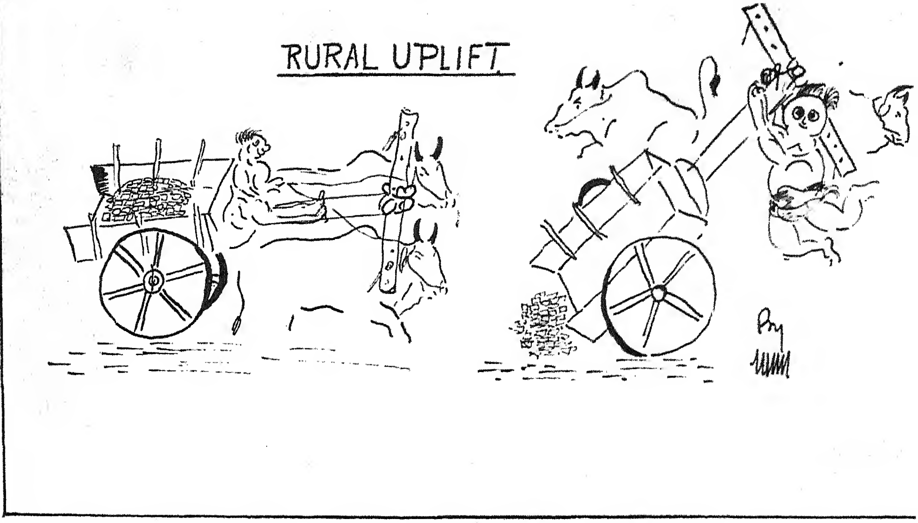
The arch-way—Humpi.

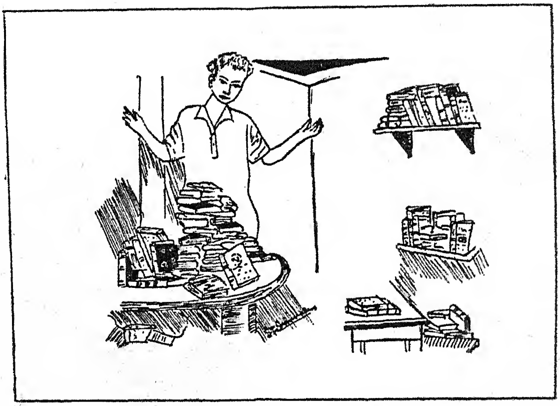


Elephants' Stables.



Power House—Mettur.





TO BE OR NOT TO BE!

Superstition.

SUPERSTITION is a faith or an article of faith, based on, ignorance of ideas regarding the deity; a practice or observance founded on such a belief, regarding supernatural phenomena! Superstition is in-born in man—no man or woman being entirely free from it. It is only a question how deeply superstitious one is.

Superstition has its votaries from among all classes and a faith so widely extant among the peoples of the world, must have that "mysterious something" about it, which the human imagination cannot solve. After all what precious little do we know of the "Mysterious universe"!

Cold logic and reasoning dismisses superstition as a matter on which no sane man can possibly pitch his faith, but logic like statistics often gives a wrong impression of the true state of affairs!!!

There are, however, certain observances by certain individuals or class of individuals, which make others 'laugh and grow fat'.

How is a live cat worse than a human corpse? Can a Hindu have peace of mind for the rest of the day, if he encounters an ordinary domestic cat on his way to an important engagement? How elated he feels if he sees a dead body carried on a bier, instead of seeing a cat? How does a dead body bring man more luck than a living sprightly cat?—Similarly, a bundle of fuel, a solitary Brahmin, a red *sari*, a poor widow and etc., etc., all come in the 'Cat', class.

Isn't it a sign of lasting good luck for the day, if you should see the first thing in the morning—a jackal? But alas! jackals are rare, and rarer still as objects to be seen first in the morning at a convenient angle, as you get up from your bed. How does a jackal bring you success when the cat fails you miserably?

A particular day of the week is more auspicious to some, while the same day is inauspicious to others. Why? Even the different hours of the same day hold in store for you different intensities of good and bad luck. How wonderful and illogical must have been the Creator to have ordained it so!

No. 13 and a broken mirror are harbingers of bad luck to an Englishman. How does an ordinary number and a broken glass affect the life and destiny of a man? For my part, I should certainly like to own 13 lakhs of rupees instead of twelve or a broken mirror instead of none.

There is nothing more repulsive to a Hindu than the sight of a poor widow. Are we not adding an insult to injury to the poor helpless being, who is already stifling under the unredeemable loss of her only solace—her lord, her husband? Why should the sight of an elderly lady, who should be all the more revered,—be so abhorring? Is it not a case more worthy of human pity and sympathy than abhorrence?

A friend of mine, a distinguished cricketer remained unbeaten, in a practice match after compiling a huge score. The next day he had to play a first class match and he appeared in the soiled clothes he wore on the previous day. He asserted that he was careful enough not to exclude even his cricket shoes while going to bed, lest he should miss his luck that had stood him in good stead. Was it not a great disappointment to him to be dismissed for a duck after wooing so carefully and with such great trouble the mistress of luck?

Then there are people who go to races with a particular suit of their favourite colour, which they believe is the forerunner of luck. Is it not an insult to our intelligence that a particular shade of our clothes or something of the kind should make a dud horse win because we have backed it? It is hard to believe,—and if we believed it is a shame for humanity, that the great order of things can change its course by a fanciful man wearing odd old clothes of a particular colour. If they could, would not the great universe come to a standstill?

But a thing so universal as superstition must indeed be a factor that cannot be easily set aside or ignored. Apart from all the baneful effects that it primarily has, it acts wonderfully in every-day life. A man setting out on an errand or a task meets with some favoured object or thing which he believed to be lucky. And this little encounter gives him some occult power and necessary fillip and he goes out with renewed zeal and zest to see himself through. Thus it adds an extra 'something' to him. The reliance on the supernatural is one of the sources of power in men of blind faith. But superstition is not without its reverses and disappointments. It is often a dead weight that sits heavily like a vampire on our chests and suffocates us almost to death.

We see before our very eyes a great array of men pass into the unknown, but none returns to tell us what is beyond. We plod endlessly, from day to day, into a future that stretches before us like a wall of impenetrable darkness, that we could almost touch but never overtake. But this endlessly alluring theme—superstition, takes us beyond the grim mask of the present and gives us an imaginary view of the future stretching before us. Wonderful indeed!

How do these superstitions come to stay with us? Through mere force of habit, a lack of the spirit of questioning; lack of eagerness and curiosity of the intellect. These shadows of the past have got established and a man who challenges with his rational criticisms, encounters the risk of being suspected as an evil genius running amok.

An ultra modern man may not believe in past traditions, customs and conventions, but has at least that savage philosophy—superstition to a degree. The most civilised man of the Occident is no less susceptible than the man of the mysterious Orient. It exists in some form or other, everywhere and with every race.

Superstitions are thus many and various. They are both a habit and a fancy. Reason takes a holiday while you are under their fanciful embrace. It is a disease of the human mind which dims our faith and is infectious. Does that mean that it is a dark spot on an otherwise brilliant surface and the most civilised among us is still a stupid victim to ignorance?

M. R. Mohan Punja.

Is it a Fact?

That Mr. Sambamurty, enquired as to why the *nets* are not put up during cricket matches.

That the Research Engineer has asked for the cycles of the following gentlemen to serve as models for the tractors he proposes to design. Thyagaram's for trackless type. Prabhakara Reddy's for pneumatic type. Ramana Rao's for heavy soils type. Mahimai Dass' to serve as raw material for the above.

That the first year students are circulating a subscription list to buy a Radio set for Messrs. Baig and Venkataraman so that the Club Radio may be available for the use of other members.

That block-boy Pannikar has so far saved one tin of kerosene oil for the Hostel by putting out the lantern whenever the Warden gets into a room and lighting it again when he renews his rounds.

That Mr. Ali Khan is seriously thinking of starting a Poultry Farm taking advantage of all the *ducks* he has scored during the last cricket season.

That Mr. Ibrahim Ali in a recent Foot-ball match got a serious wound in his *hind* leg.

That emerging out of the Nutrition Research Laboratory, asked as to who Aykroyd was, Mr. Srinivasa Rao was ready with the answer that it was another *gland* akin to Thyroid.

Is Life Worth Living?

> "Had I but served my God with half the zeal
> I served my King He would not in mine age
> Have left me naked to mine enemies". *(Shakespeare).*

It has been said that advances in science have effected a complete revolution in religious thought. Discoveries in every branch of Science have transformed human life beyond recognition. Knowledge has been accumulated in a way never before dreamt of, vast conquests have been made over pain and disease and each day we are adding with the aid of Science to the sum of human happiness. Everything points out to the intellectual supremacy of man. Such being the age in which we live, is it any wonder that a cheery optimism, devoid of faith in a life beyond this life has become the creed of most scientists? And yet, paradoxical though it may seem, side by side with this optimism there is noticeable a most distressing form of pessimism, which seems to be the result of eliminating the religious element. The theologian bids us repent and waste our life for past sins and in tremulous hopes that the past may yet be the future. Science tells us that what is gone is gone and that the best wisdom of life is the acceptance of accomplished facts. Such is the supposed creed of science. Belief in another life is according to Science but a mere delusion and a figment of theology. There can be no repentance, since that only leads to vain regrets and needless pain. Such a creed is merely a refined modern interpretation of the very worst type of fatalism. The modern apostles of this creed when asked the question 'Is life worth living?'—would unhesitatingly answer Yes! But if the question were pressed further and they were asked—why is life worth living?—Is it worth living because of the individual pleasures it yields, or of the general happiness it affords, or life is an end in itself, the answer in the majority of cases would be that life is worth living, because if well used it will lead to a moral bettering of the world. These are keenly alive to the transitory nature of life. But admitting all these they would still affirm that life is worth living.

The optimists of the present day who have no faith in a life beyond the present can be brought under two classes. The first includes those who adopt the lower ideal of human life and the cultivation of faculties as the *summum bonum* of life. They take refuge under vague ideas as are conveyed by the expressions "cultivation", "progress" etc. without making any reference to the ethical side of life. At the head of this class of optimists must be placed the great German poet and philosopber Goethe. No writer has laid such stress on the bright and joyous aspects of life as Goethe. "Open your eyes"

he cries "Ye are not required to search for the good in the far distant; it is here if ye will but grasp it. Learn to find joy in existence giving yourself up to the glory of Nature and that higher glory of Nature which is revealed through the products of genius;—do this and ye will discover that it is good to be in this world."

There is no doubt that there is something stimulating in this kind of life-teaching. It is but right that man should see and appreciate the joyous aspect of human life. Not only the starry heaven above but the meanest object that we tread under our feet affords food for our joyous contemplation. Of course we admit all this but a little reflection will show that the end in view placed before us by this class of optimists can by no means be looked upon as final, an end in which we can find rest and satisfaction.

The philosophy above propounded makes no provision for the majority of mankind, who do not belong to the cultured class—those that toil and suffer and are nursed in the lap of adversity. So this gospel of life cannot claim to be universal, however attractive it may appear in poetry and fiction for the cultured people.

Another flaw in this school of thought is the pessimism that lurks behind the assumed optimism. Take for instance Byron. His poetry too, mirrors in striking splendour, all the glories of life. Byron was consistently true to nature, but what was the consequence? His optimism ended in a most dreary type of pessimism He sought his ideal in society, history and political freedom but he failed to get any satisfaction and fell back on the positive and actual. Everywhere he found nothing but a cry of anguish, wrung from the heart's core.

> " One desert
> Barren and cold on which wild waves break
> But nothing rests, save carcases and wrecks
> Rocks and the salt sea, weeds of bitterness"

This then is the outcome of the optimism of Goethe, when carried to its logical conclusions.

Now we come to the second class of optimists who attach the greatest importance to the ethical aspect of life. To this class belong modern thinkers like John Stewart Mill, Herbert Spencer and others. These people lay the greatest stress on the importance of virtue, the dignity of life and earnestness of the moral struggle. The majority of thinkers of this positive school are utilitarians. The *summum bonum* of life according to them is the greatest happiness of the greatest number. They say an act is right if it leads to this end. In the first place the upholders of this theory are inconsistent in rejecting 'individual happiness' as an end and substituting instead the happiness of the multitude. They resorted to this in order to clear themselves of the charge of selfishness brought against their view of morality.

Secondly the test of 'inwardness' is inapplicable to this view of morality. We call a man wicked if his motives are wicked, no matter where his acts lead to. If happiness is the standard of virtue, morality loses its absolute character altogether. But far different is that moral system backed by the belief in a personal God and in a personal immortality. Instead of man's immediate happiness as a standard of virtue substitute God's will. The thought that we owe our existence to a personal God to one whom we can address as "Our Father" who can read the very secrets of our life—such thoughts undoubtedly place the relation in which we stand to our fellowmen in an entirely new light. It has been very well said that "It is only from the filial relation that the paternal springs." Nothing but a belief in a personal God can give a logical and full account of the true nature of moral ends. Man helpless as he is, bound down to lower aims by ties of self and sin, can never hope to have his higher aims realised, unless he trusts himself implicitly to the Power that works all things. Life is not worth living unless it is spent for others and in bettering the world and all our efforts to improve this world will end in emptiness if we are not sustained by a belief in a personal God.

N. Srinivasulu.

Believe it or not.

Mr. P. K. Sivasubramanyam mistook the turf bowling pitch on the college maidan for a tobacco nursery.

Mr. Kanakarao does not get straight furrows in ploughing because of the frequent intervention of Konda the Farm coolie.

Mr. P. V. Ramanamurty affirms that there is an *alf-alfa* cream separator in our Dairy.

Mr. Gona Rama Rao says that every Botanic garden should have a *crockery* for growing its Xerophytic specimens.

Mr. Yakub Sha believes that *vaseline* is used in embroidery.

Mr. Tiruvegatachary consumes only 15 lb. of tomatoes whenever that dainty is on the menu.

Mr. Panda never fails to hear any Carnatic music broadcast from the B. B. C.

Mr. Devadass Kamath's voice has been expressed by a mathematical formula as being inversely proportional to his size.

My First Cricket

FEW of the human race realize that the eminence they attain in life is not acquired in the cradle. Many a young man resorts to ridiculing his companions, accuse them of laziness merely for the reason that they are not competent enough in the particular occupation in which he is an adept.

Goaded by my adventurous comrades who were unmindful of the saying that "a little knowledge is a dangerous thing'" I offered myself to run the risk of playing the hazardous game of cricket in one of the local matches. I spent sleepless nights awaiting the day of my impending trial. At last it came. Clad in khaki shorts I rushed to the field with a half consoled stomach. A strange man in a strange group of anglicised Indian youths in white pants. The misfortune to be on the fielding side and bake in the scorching sun had fallen to my poor lot. One by one the battalion of eleven strong men now emerged out of the pavilion.

The game began in right earnest and I was directed to a remote corner of the ground to keep watch on the ball. A miraculous capture of the three wickets at either end of the pitch—and so soon! The game of cricket—a funny thing to behold! Standing in the field I fell into a reverie when suddenly a ball rushed towards me. I hesitated to touch it for fear of being hurt but pride prevented me from leaving it. Pouncing upon the ball I stretched my hands but to no avail. It escaped between the legs and turning round I saw it already several yards ahead of me well on the way to the boundary line. Ah! what a degradation! A rattling noise from behind; a terrific hooting from the pavilion; a contemptuous grin from the field. Yet I remained cool, calmly picked up the ball and threw it back to the wicket keeper. The very next moment I was driven away to a distant corner, a more skilled man usurping my former place. Little was I perturbed. The next ball that came failed to escape my firm grip. What a delight! a score of voices shouting "well fielded" Suddenly a change was wrought because of my meritorious services; orders were issued to guard the ball from very near the player; a position which I had thought to be as high and safe as that of a Duke. But my fears increased when I began to think of the dangers in that near position. Fearing the wrath of the chief, I ventured to check as many balls as I could, but only to please a few and displease many. After four hours of unceasing torture in the scorching sun, I returned to the pavilion with the rest, silently resolving within myself to give a real trouncing to our opponents.

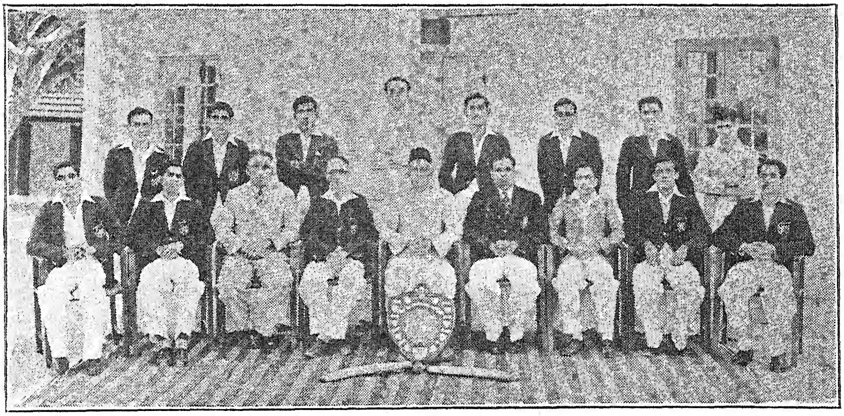
Although disappointed to the core of my heart on finding I was to be only the last man to bat, I entered the field in due course with all the usual regalia. How ugly the body appears in pads and gloves! I was hardly able to walk to the pitch with the additional burden of a cricket bat. The preliminary rites at the pitch were all finished somehow and I got ready to offer a firm stand in defending the three sticks, where my predecessor had fallen bleeding. The first ball! It came with a lightning speed. With unflinching courage I rushed forward to meet it. Hush! a shriek from behind startled me: I turned round only to behold with grief my own downfall!

Thrown into inconcievable depths of despair, I returned to the pavilion amidst sarcastic gestures and derisive shrieks. Thus the insatiable ambition of a youth to quench the thirst for public applause received a violent set-back in its infancy itself.

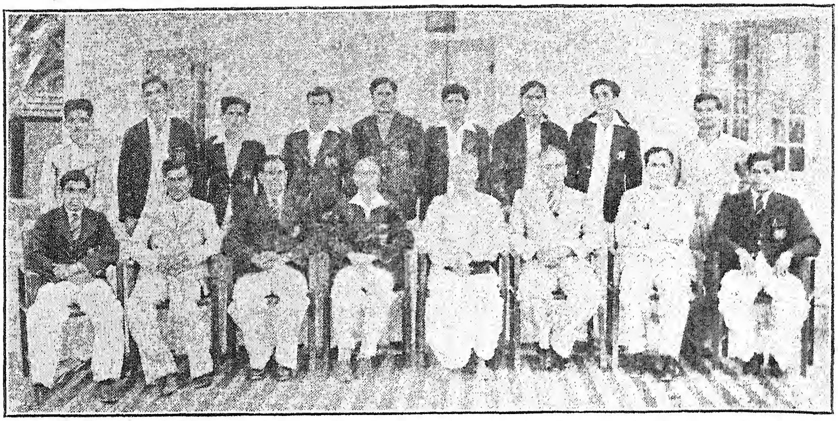
New Year Resolutions.

S. V. Srinivasan.	To take practical tips in table tennis from eminent players of the Officers' Club and thus secure this year's honours in that game.
G. Ramalingam.	To put in at least 8 hours of effective mugging every working day.
Mr. Hegde.	Not to participate in any out-door games in view of his indifferent health.
Gona Ramarao.	To equip himself in such a way for the exam that he might smash all previous records, especially those of Mr. Sankaram.
C. Sankara Rao.	To run round the maidan twice daily so that he may be more swift in running between the wickets.
Ramaswami and Sridharan.	To attend classes regularly.
K. Sambamurty.	To keep himself in readiness with bundles of typed materials etc., for accepting the school-master's post likely to come his way in 1943.

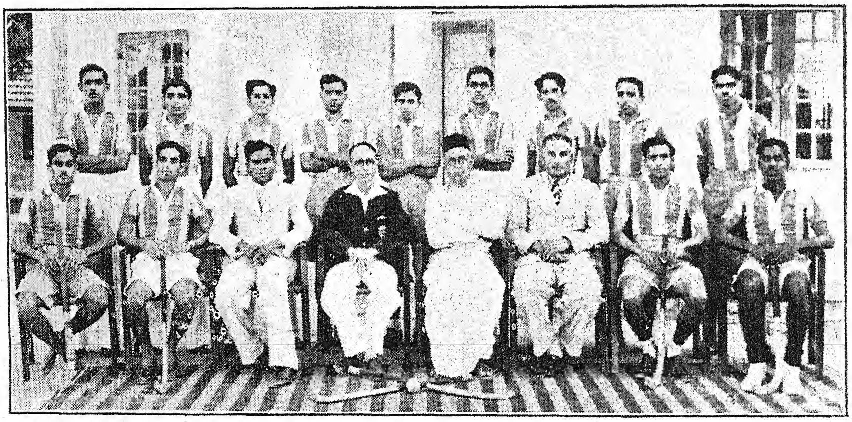
The College Foot-ball Team.



The College Cricket Eleven—Winners of the Rhondy Shield.



The Members of the Executive Committee, Students' Club, 1940—41.



The College Hockey Eleven.

Random Notes.

OUR child, the literacy campaign, nursed by our exalted Warden, would have become great, had it not been killed before it was born.

The leader of the ill-fated campaign perversely pitched upon a site inevitably involving transportation by bus or taxi and consequently the exuberant volunteers flocking '*enmasse*' for the sheer picnic value of it were uncontrollable. It was not with that idea the suggestion was thrown out. The compaigners could as well have served the folk of the adjoining village Pujaripalayam, who we feel sure, are not so literate as the Agricultural College students.

*   *   *   *

The Secretary of the Students' club declared in one of the momentous gatherings that it is clearly not one of his duties to go round and collect students on the eve of every ceremonial occasion. We sympathise with the Secretary for the underlying principle of individual discretion, advocated in spite of the risk of unfortunate speakers dealing with inanimate audiences.

*   *   *   *

But you are supposed to be generous. Why not give a lift to all the 'glass rods' in the hostel on your cycle? However there are certain exceptions whom you cannot try to carry without the fear of colossal disaster to your machine. Purchase a good double bullock cart on behalf of the Club. Golden opportunity Ye! gentiles, Ramana Rao and Rama-Sub.

*   *   *   *

The popular cry at the budget meetings every year is that the demands of Cricket dominate the expenses of other club activities. Well, it calls for a clear revision of procedure. But do you want to deny us the privilege of rapidly gaining fame for our college and hamper the dynamic momentum with which our players top the Presidency standard? No.

Those dis-interested gentlemen—a special contribution of Agricultural College—racking their brains in the rusty books of the neglected library rooms can well keep out of the ventilators and get a view of the Cricket matches going on. Don't be frightened by the high class ducks scored. All indigenous! You can start a poultry farm.

*   *   *   *

A smart first year student going through the final year's Agricultural paper, with characteristic impunity suddenly exclaimed "Bah!

does it really require three years' study to know how many birds are required to supply 100 eggs per day? 100 pullets and 100 cockrels to mate them. Where is the difficulty !"

* * * *

Interesting revelations were made in a recent debate regarding the uniform of the lady students who may join our College. A speaker seems to have been in intense perplexity whether after all, this would not stand in their way.

* * * *

An agricultural student of the first year class, at the end of an interview with an actress, exclaimed with a hint of modesty, 'Madam, I am sorry, I am cockroaching on your time', The lady gently smiled correcting him, it is *encroaching* and not cockroaching. The man blushed "I did not think it very necessary to stick to genders in this College, where English is not a subject. How-ever, I should have said, 'hencroached' when speaking to ladies".

Looker on.

Some Facts that you would be interested in.

In the Bellary tract you will find 8 pairs of bullocks working *behind* a *pedda madaka.*

Field No. 37 is meant for the cultivation of Students.

The original home of India is Sugarcane.

The entire nebulous mass is comparable to a tennis ball, hockey ball, tennikoit ball or any ball.

Cobras are used for digging Hariali grass.

Zuiderzee is a rivulet of Zambisi in Australia.

Jennet is another name for rennet.

Peru is famous for Chilean nitrate.

The activated Sludge plant is slowly coming into cultivation.

Sesamum indicum is the eucalyptus tree.

Vigils and bigils are used in refereeing foot-ball.

Gunga.

THE morning dawned in unclouded splendour. The limbless charioteer ARUNA had come far up in the sky, announcing the advent of his master *Dinaker*. Dinaker was peeping through " the rolling mountains ", now appearing and now disappearing, flashing his bright smile over the dancing waves with foams scattered like pearls hanging in the sky.

It was the *Vaisaka Amavasya* day. People from far and near had come to bathe in the sea, and purify themselves. Many children were playing near the breakers, but as the waves rushed on they fled back to their parents. Some school-going students who boasted of their swimming ability were trying to exhibit their prowess before beautiful belles bathing near by.

All of a sudden the wind began to blow stronger, the clouds began to thicken, the waves began to thunder and being terrified, the birds twittered and flew helter-skelter. All began to rush to the shore.

There was an ear-splitting shriek from a corner. I rushed to the scene. I saw an urchin caught in the current. I waded and swam through the water and caught hold of him. All of a sudden I heard an uproar, headed by my father's thunderous voice. " It is Gunga, the Pariah boy. Leave hold of him. Are you going to pollute yourself ? " I was confused and let go the boy's arm. There was a mighty swoop, a wave came and the boy was carried away. I turned back. The two imploring eyes of the mother were looking at me with contempt. I made another attempt to save the child, but it was too late. The waves had carried him far out of my reach.

I slowly turned back, I dared not look at the face of the mother, nor at the faces of my own people. All were looking at the sea with a " philosophic calmness ".

After an hour the body of Gunga was slowly washed ashore. The mother of the boy rushed to the spot. There was not a drop of tear, but she looked, looked at her dear son's face. The strain was too much for her. She suddenly collapsed.

I wanted to go near the woman, and help her. The terrible look of my parents non-plussed me. With a sullen look I slowly returned home all the while thinking of the poor boy and the helpless mother.

The night came. I could not sleep. The ghastly face of the boy, the tender, pathetic face of the mother began to haunt me. She was carrying the boy in her hands. She laughed a ghastly laugh and seemed to say " Are these the social customs that you are proud of ? You are a coward, a murderer. You are responsible for the death of my son."

I woke up. But there was only the darkness mocking at me. I saw the shining stars twinkling, making faces at me. *S. B. Pezavar.*

Holy Badrinath and My Visit to the Sacred Shrine·

BADRINATH, the dreamland of 'Bhakthas' and the fairy-land of travellers and mountaineers is situated in the heart of the famous Himalayas, the king of mountains and pride of India. The place is surrounded by lofty mountains and snowy peaks with a back-ground of awe inspiring scenery. The altitude of this place is about 11,400 feet above sea level. And here where Nature's glory is exhibited in multiple forms, is situated the beautiful little temple of Badrinath. The Lord is seated in the *Yoga* posture inside this shrine. This temple is considered to be the most sacred in India... and it is the ambition of every Hindu to offer his respects to the great Lord Badrinath at least once in his life time. Though this is the dream of thousands, circumstances favour only a fortunate few in the realization of their dreams. Here, I am proud to include my name among the fortunate few.

There is a hot spring (122° F.) known as 'Tapta Kundam' the water of which is said to contain valuable healing properties. But for this hot spring any pilgrim to this place will feel reluctant to take a bath in the ice cold water of the mighty *Alakananda* river. It is a heavenly pleasure to take a bath in that hot spring of Badrinath where the weather is extremely cold.

Few can resist the temptation of visiting this place when they come to know about the greatness of Badrinath, the Himalayan grandeur and especially the foot-path leading to Badrinath. The path runs on the bank of the roaring *Alakananda* which has a snake like curling course in the deep valleys amidst lofty mountains and the snow clad peaks afar.

When once we step into the enchanting regions of the famous Himalayas, we forget all our worldly worries and immerse ourselves in the happiness of enjoying the choicest beauties of nature which we see round about us. On our way to Badrinath we meet with the inhabitants of those regions. They are all very fair-looking, wearing cheerful smiles, and have well built bodies and rosy cheeks. They lead an extremely simple life. They are indeed the real children of nature, the wonderful pictures of health and happiness, who reflect in their guileless countenances the love of the creator. 'Their best companions are innocence and health and their best riches are ignorance of wealth'.

The temple at Badrinath is open only for six months in the year. The other six months the whole place is covered with snow. The

place becomes habitable only from the first week of May. Though the temple is open between May and October, the best months for making a comfortable journey are May and June. We see during these two months, pilgrims pouring into this place in thousands. Pilgrims from all over India (from Kashmir to Cape Comorin) visit this place. It is very interesting to see people with different modes of dresses, complexions, peculiar customs and manners at the same time in a place like Badrinath. We see people who are lame and old and sickly women and children along this journey with a buoyant spirit and bubbling enthusiasm. It is the immense faith in the Almighty that makes all these pilgrims visit Badrinath walking a distance of about 190 miles, all the way from Haridwar to Badrinath. We never feel the tiresomeness of the journey. After walking a distance of 12 to 15 miles a day, we get very good sleep in the night. In the morning, a refreshing bath in the ice cold waters of the Ganges makes the pilgrims fresh and buoyant for that day's walk. We have to spend about 20 days in that happy abode of God and men, the famous Himalayas which combines the rugged grandeur with the delicate beauties of nature, for our journey to Badrinath and back. "Jai Badri—Bhisal"!!

S. V. Sreenivasan.

Latest Researches.

1. Alga is a legume.
2. Cambadicumbu is a strain of sorghum.
3. Colostrum contains collossal materials.
4. Standardisation experiments are those that are standardised.
5. *Kolingi* is a kind of timber tree,
6. Eggs are graded by the weight they contain.
7. A plot measuring 33′×33′ is one Guntaka (gunta) and 40 guntakas (guntas) make one acre.
8. 360 days make one year.

Tatler's University.

THE University was started in the year 1937 in Pujaripalayam by the present Raja of Pujaripalayam with a view to give higher education to his subjects. He constructed various buildings to lodge the Colleges, the University offices, and the convocation hall. However, this university is quite different from any other with which we are familiar. Many students are attracted from all parts of the country to study here and get their degrees. The students are carefree, 'happy-go-lucky' people. Of course there is a good library but nobody uses it. There are no examinations, no work, no attendance and no lectures. The student enrolls himself for a particular course. For each course there is a definite period of stay prescribed and the moment he finishes his course, he gets the degree. It is a common experience of all students to feel a great anxiety and botheration at regular attendance and examinations. But what a contrast we find in this University. For people who are anxious to know more of the courses conducted by this University, a few of them are given below :—

B. D.—Bachelor of Dullness—Extends for 2 yrs.
M. D.—Master ,, ,, — ,, ,, 4 ,,
D, D —Decidedly Dull ,, — ,, ,, 6 ,,
Ph. D.—Phenomenally Dull— ,, ,, 5 ,,

The moment a student steps out of this University after finishing his course, he is welcomed and given a job according to his degree in the state departments. The degrees are very highly valued in the state. For details about the University, apply to the Registrar, Tatler's University, Pujaripalayam, Coimbatore, South India.

C. Srinivasan.

Students' Annual Club Day Celebrations 1941.

The Annual Club Day was celebrated on Saturday the 22nd February, 1941, with great eclat and enthusiasm. It was a day of triumph, merriment and unalloyed happiness to all of us. The sports and tournaments connected with it had been concluded earlier. The celebration of the happy day commenced with "Tea" at 4-30 P. M. The fancy dress competition provided great amusement to visitors. After tea, the guests and students adjourned to the tastefully decorated Freeman Hall, when a meeting was held with A. R. C. Westlake Esq., I. C. S., District Collector, Coimbatore in the chair. Students P. Paramananda Panda and Narasimham deserve great praise for the exquisite and artistic way in which they decorated the hall.

Prizes were distributed by the President after reading of the report for 1940—41 by the Secretaries. This was followed by an interesting Variety Entertainment which commenced with a song from student M. Ramalingam.

The pleasant function terminated with the presidential address. Sri Rao Bahadur G. N. Rangaswami Iyengar, Principal of the College, proposed the vote of thanks.

The following is the list of prize winners in the various events held in connection with the Club Day :—

Indoor games.

	Winner.	*Runner up.*
Table Tennis Singles.	T. K. T. Achari.	T. Venkateswara Rao.
,, ,, Doubles.	S. V. Sreenivasan & Hegde.	T. K. T. Achari & D. Narasimhamurthy.
Carrom Singles.	Y. V. S. S. N. Murthy.	Ramakanta Reddy.
,, Doubles.	Y. V. S. S. N. Murthy & partner.	C. M. George & Panda.
Chess.	Sreethara Sastry.	B. S. Krishnan.

Sports.

Tennikoit Singles.	Ramakantha Reddy.	Picheswara Rao.
,, Doubles.	Ramakantha Reddy & partner.	B. Narasimham & partner.
Volley Ball (6)	Devadas Kamath's team.	
Volley Ball (9)	Krishnamoorthy's team.	
Badminton Doubles.	Hegde & partner.	Krishnamurthy & partner.
,, Singles.	A. Subba Raju.	P. Venkateswara Rao.
,, Fives.	A. Subba Raju's team.	
Tennis Singles-	Unfinished.	
,, Doubles.	A. Subba Raju & George.	Hegde & Subba Rao.
Inter Mess Tug of War:—	Non-vegetarian Mess.	
Inter Class Relay:—	Class I.	

Scooping the Hockey ball:—1. D. Chinnappa Reddy. 2. P. Y. Chintamoney.
Ring round the stump;—1. K. R. Hariharan. 2. P. Venkateswara Rao.
Kicking the foot ball:—1. I. L. Narasimha Rao. 2. C. V. Govindaswami,
Bowling at the stump :—1. Ramesh Adyantaya. 2. J. P. Nageswara Rao.
Slow cycle Race:—1. D. Daniel Sundararaj. 2. A. Subba Raju.
Chatty Cycle race:—1. D. Daniel Sundararaj. 2. P. Venkateswara Rao.
Wheel barrow:—1. I. L. Narasimha Rao. 2. D. Chinnappa Reddy.
Leap Frog Race:—1. D. Narasimhamurthy & partner. 2. D. Chinnappa Reddy & partner
Blow Ball:—1. D. Narasimhamurthy's team.
Musical Chair:—1. D. Daniel Sundararaj. 2. C. M. George.
Three-legged race :—1. R. M. Sastry & partner. 2 D. Narasimhamurthy & partner
Fancy Dress:—1. T. Chellappa. 2. V. Mahimai Das. 3. S. N. Ramasubramanian.
Parlakimidi Cup for the allround sportsman:—K. M. Somanna, Class III.
S. V. Sreenivasan, Class III

Award of College Colours.

Athletics:—1. K. Narayana Kamath, Class III. 2. C. V. Govindaswami, Class I.
Cricket:—1. Monappa Hegde, Class III. 2. C. Sankara Rao, Class II.
Inter Class:—1. Victory Cup. Class III. Parnell Cup. Class I.
Cricket. Sri. K. M. Thomas's wards.
Hockey. „ do do
Foot ball. „ M. Kantiraj's wards.
Literary Competition—Elocution:—1. H. Gurubasappa. 2. B. Seshavatharam.
3. G. V. Raghavalu.
Inter-tutorial Elocution Competition:—Sri. B. M. Lakshmipathi's wards.
Essay Competition:—1. Seshavatharam. 2. N. Sreenivasalu. 3. A. Adivi Reddy.
Special cup for the best student artist:—Paramananda Panda.

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EDITORIAL

The place of Universites in Agricultural Research. Agricultural research embraces a wide range of basic sciences so that research on a multitude of agricultural problems of the Indian sub-continent demands the marshalling of a great variety of scientific talent available in the country. Taking a cue from the experience of even highly industrialised countries of the world, it is apparent that the universities of those countries are taking an equitable share in research on agricultural sciences and are working hand in hand with the official ministries of Agriculture for the solution of specific problems calculated to enhance the prosperity of the agricultural population. We are aware that here and there in India some of the universities are beginning to realise the importance and utility of collaborative effort with other research organisations in the country. But it is well-known that the sum total of such efforts is still meagre when we consider the number of universities functioning in the land or the number of professorial chairs held by them. The old criticism that Indian Universities bestow undue emphasis on teaching and examinations is evidently a thing of the past. In recent years there has been a welcome awakening among the older universities and the newer ones are constituted with an avowed purpose of doing research, with the result that the importance of fostering research as one of the primary functions of a university is now universally recognized. Most, if not all, of our universities are to-day adequately equipped in men and materials for undertaking at least some aspects of the most exacting problems confronting the Indian tiller of the soil. It is often said that most of the universities lack the facilities and the resources to run a first class experimental station for the study of agricultural problems. But those holding this view forget the patent fact that by virtue of the high standard of pure science studies maintained and by the possession of excellent laboratory equipment, the universities are often more favourably placed than most agricultural research stations for the study of several fundamental principles and the purely scientific aspect of agricultural problems which elude the average agricultural investigator. We are of the opinion that with some additional facilities like a pot culture house and small strips of cultivable land, any university in India should be in a position to undertake the study of subjects like drought-resistance in crop plants, the function of rare elements and plant hormones, the assay of active

principles of drug plants and vegetable insecticides, the function of stickers and spreaders in spray mixtures, the chemistry of milk products and the cytogenetics of crop plants. We have often heard eloquent pleas from several platforms on the need for greater co-ordination of research work between agricultural workers and the universities; but apart from these appeals there has been little progress. To our mind, the chief impediment in the growth of such a healthy institution is the lack of contact between the two categories of research workers and the consequent ignorance that prevails among one class of what the other is doing. Perhaps another impediment which is apparently peculiar to India is that as our present system of scientific education is constituted, the parting of ways between the votaries of pure sciences and applied sciences begin at a stage which is too early in the career of our university students so that there is no scope for the cultivation of mutual appreciation of each other's talents. Nevertheless, it is undisputed that there exists the need for finding ways and means to effect the much-needed co-ordination by which one class of workers can supplement the work of the other. The time has arrived when in the interests of the country, all differences are sunk, prejudices cast aside and a genuine desire is cultivated to work for the common good of the motherland. It will not be possible for any one to formulate a division of labour between universities and Agricultural research stations into water tight compartments. The chief factors for success in any scheme of research are the personal capacity of the research worker and the materials at his disposal. Bearing this point in view, a very rough demarkation alone is possible. Some overlapping of effort is inevitable in the beginning but this need not be a serious obstacle to orderly progress.

The time is ripe for an organised and representative body like the Imperial Council of Agricultural Research to make a definite move by inviting representative research workers from all the universities and agricultural departments in India and take stock of the facilities that now exist for inaugurating research on specific agricultural problems. The next step would be to invite from the universities definite schemes each of which can be considered on its merits.

Industrial uses of Cashew and its Products.*

By C. M. JOHN,

Oil Seeds Specialist, Coimbatore.

Introduction. The cashew (*Anacardium occidentale*, L.) has, of late, received commercial importance chiefly on account of the great demand for its edible kernels. Believed to be a native of South America, the cashew that was introduced on the West Coast of India by the Portuguese, has now established itself as a commercial crop in the States of Cochin and Travancore and in the districts of Malabar and South Kanara. It is now seen to be spreading to other parts of this Presidency, on account of its capacity to thrive under widely varied conditions of soil, climate and rainfall. The possibilities of further extension in its cultivation in regard to its occupation of land now left uncultivated due to subnormal fertility, indifferent rainfall or other reasons, cannot be under-rated.

The importance of the cashewnut in industry can easily be gauged when we note that according to the latest available figures, about 10,192 tons of cashew kernels valued at Rs. 11,411,170 were exported from British India during the year 1936—37. Of this, S. India contributed 8,799 tons valued at Rs. 9,971,567 while Bombay was responsible for the remainder. The value of exported cashewnut kernels from India is about 82 per cent of the world export trade in them which amounted to 3½ million American dollars in 1936 (i. e., about 14 million rupees).

Commercially, to-day, the cashew kernels alone are known to any extent. The cashew, however, yields certain other products, each of which foster possibilities of industrial utilisation. Though the economic uses of these products have been established, they form, as yet, only a fertile field of unexplored wealth. This note collates the already recorded uses to which the products of cashew can be put, and it is hoped that it would stimulate interest both in regard to the extended cultivation of cashew and its increased industrial use.

The cashewnut. The cashew is chiefly cultivated for the valuable kernels that it yields. In India the cashew kernels both "raw" and "roasted" find a place in a variety of household preparations. In Europe and America the kernel is largely used as a "dessert" nut and for making confectioneries, particularly in the manufacture of nut chocolates. It provides a cheap source of protein and is considered better than other nuts

* Contribution No. 15 of the Oil Seeds Section of the Madras Department of Agriculture.

A contribution to the Symposium on "The Industrial Utilization of Agricultural Products in India" held under the auspices of the Indian Science Congress during its Madras Session in January 1940.

because of its high biological value. Table I below gives a comparative statement of the protein content, true digestibility and biological value of cashew and other commercial nuts.

TABLE I. Protein content, true digestibility and biological value of cashew and other nuts.*

Descripton of nuts.	Protein % (Crude)	True digestibility.	Biological value.
Cashewnut fresh	19·52	$96 \cdot 23 \pm 0 \cdot 16$	$72 \cdot 50 \pm 0 \cdot 66$
Blanched almonds	21·94	$93 \cdot 95 \pm 0 \cdot 23$	$50 \cdot 84 \pm 0 \cdot 37$
English walnuts fresh	21·16	$84 \cdot 11 \pm 0 \cdot 22$	$55 \cdot 89 \pm 0 \cdot 92$
Groundnut raw	28·25	$97 \cdot 39 \pm 0 \cdot 27$	$57 \cdot 90 \pm 1 \cdot 1$

* From Mitchell, and Readles (1937).

The cashewnut is also said to contain vitamins A and B_2. It contains about 40 per cent of oil of high nutritive value equal to that of almond oil and superior to olive oil. The oil, it is reported, can be utilised with advantage in certain pharmaceutical preparations. It is not of much interest commercially at present as the price of the kernels is too high to be utilized for production of oil.

In spite of all these advantages the cashew kernel is marketed in India in a very indifferent manner. No proper grading or hygienic packing of the stuff is undertaken in the internal markets though some attempt in this line is made with the stuff exported. Joachim (1936) in his studies in the "Vita-pack" process for preserving cashewnuts has found that the packing of well dried cashewnuts in well sealed receptacles containing dry carbon di-oxide gas is a very effective means of preserving them for no less than eight months (the duration of the experiment). The trials also appear to indicate that provided that the nuts are thoroughly dried, they can be preserved for this period of time in well filled and well sealed containers without carbon di-oxide. An organized production, grading, packing and marketing, would thus, certainly induce greater utilisation of the produce in the confectionery trade and better sales both in the home and foreign markets.

The Shell. The cashewnut shell contains 29 per cent of a reddish brown oil of which 10 to 15 per cent is obtained during the roasting of the nuts, which is commonly done in open pans over a small circular earthern furnace. As nuts get roasted the oil exudes out and is drawn off at one end. The oil contains anacardic acid, gallic acid and cardol. The shell oil finds extensive use in the preparation of varnishes, synthetic resins, moulding compositions, insulating coating, inks etc., as a preservative paint for boats and fishing nets, and as a protective for floor and wooden rafters against termite attack. The acrid oil is medicinal and "has been used as an anaesthetic in leprosy and as a blister in warts, corns and obstinate ulcers". In combination with kerosine or crude oil, it is lethal to mosquito larvae. In addition to these uses, further interest in anacardic acid which

forms 90 per cent of the corrosive oil has arisen recently as an antiseptic for textiles, the anilide and analagous derivatives of the acid being expected to combine the antiseptic properties of "shirlan" with a wetting power from its polar hydroxyl and hydrophobic long chain alkyl residue.

It is estimated that about 11,000 gallons of this oil are annually exported to Europe and particularly to America under the trade name of "Cardole oil". The price of the oil varies from 8 to 12 annas per gallon. It is also computed that "about 32,000 tons of raw cashewnuts are roasted every year in India and thus at the present rate of kernel production nearly 13,000 tons of roasted shells containing nearly 18 per cent of oil are available which could yield 53,000 gallons of the roasted nut shell oil". It may be possible to improve the process of roasting with a view to greater recovery of the oil.

The cashewnut shell is at present largely used as fuel in the process of roasting the nuts. The partly burnt shells from a previous charge form the fuel for the next charge of the nuts. This method is wasteful for the shell is valuable for other purposes. It gives on destructive distillation a combustible gas of a calorific value which compares favourably with coal gas. A ton of cashew shells gives about 6,000 cubic feet of gas. The shell charcoal which is one third of the shell has a calorific value of coal and is smokeless.

The Cashew Apple. The apple which is the swollen pedicel of the fruit is edible and on a small scale is eaten fresh or preserved with sugar. It has antiscorbutic properties containing as it does vitamin C. It is determined that 1 ounce of the fruit contains 120 milligrams of vitamin C and the normal requirement for a man is 50 milligrams. By fermentation either alcohol or vinegar can be obtained from it. "Dr. F. Marsden finds that 100 gms. of the apple yields 70 c. c. of juice containing 11·2 grams of invert sugar and on an average 3·8 per cent of alcohol". The invert sugars of the apple are valuable for inclusion in infant and invalid foods. These can be made available by converting the juice of the apple into a syrup which preserves the invert sugars. When mixed with iron sulphate the juice is said to make a good hair dye.

The cashew apple, thus, should be given further attention. An attempt should be made to utilise this fruit in the different ways indicated above instead of allowing it to be wasted. Preservation of the apples particularly of the sweeter varieties in sugars can be organised as a cottage industry.

The Cashew Wood. Cashew timber is used for making country boats and packing cases. The wood is red, moderately hard, close grained and weighing 38 lb to the cubic foot. The resinous gum which exudes from the bark of the tree is said to be deterrent to insects and can therefore be used for book binding. It is also useful in tanning. The sap obtained from the incisions on the bark is utilized as an indelible marking ink. The charcoal of the wood is highly estimated by the iron smiths of *Tavoy* and West Coast.

Conclusion. These are but a few of the many and diverse uses to which cashew and its products can be put. Many of them easily lend themselves to industrial exploitation. More than that, the products of cashew can replace many of the materials that are at present of necessity being imported into this country. Where India could be self sufficient in its needs of small scale industries, by the utilisaiion of the wealth that is so easily procurable, cashew has abundant potentialities. A little more research on the side of industrial utilization of the different products should put the cashew industry of India on a sound basis for fuller expansion.

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Revised Names for some of the Madras Grasses.

By S. N. CHANDRASEKHARA AYYAR, M. A.,

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Among plants that are useful to man, grasses are by far the most important. The crops that provide the staple food for the greater part of mankind, namely, paddy, wheat, maize, sorghum, ragi, *cumbu* and *tenai*, belong to this group. The animals that furnish food and labour, wool and leather live principally on grasses. Besides giving us food, grasses are sources of starch, alcohol and sugar. In America enormous quantities of cooking oil are secured from the germ of corn (*Zea Mays*). A good many grasses furnish material, for making brooms and brushes, and some are important sources of fibre for the manufacture of paper and cordage. Some yield essential oils. In many parts of India and a great part of Asia, bamboo which is a giant grass forms the principal timber for the construction of dwellings of the poor and bridges over village streams and also furnishes material for a variety of articles of domestic use and cheap furniture.

The family Gramineae to which the grasses belong is a very large one consisting of 500 genera and 4000 species of which in the Madras Presidency we have 132 genera and 388 species The list of genera and species in the Madras Presidency has been revised by C. E. C. Fischer, late of the Indian Forest service, and was published in the year 1934 as Part X of the Flora of the Presidency of Madras by J. S. Gamble. The Revision has been done after considerable scrutiny at Kew. The material for the Madras Flora was mostly from the Madras Herbarium at the Research Institute, Coimbatore, and in the preparation of the Flora, Mr. C. E. Hubbard of Kew gave considerable help and guidance. The genera are those adopted by Mr. Stapf in the Flora of Tropical Africa wherever possible.

Since there has been considerable revision and change of names, both in the genera and species, and in Madras, the names of as many as 211 species have been changed, the revised names are all brought together here with the old names given opposite to each of them, so that the list may be of help to the research student for ready reference.

It may be seen from a perusal of the revised list of names that among the genera that have undergone change the following deserve mention viz., *Andropogon, Panicum, Eragrostis* and *Ischaemum*, as in their case several of the species have now been placed entirely under new genera while some others have been given new specific names.

I am very much indebted to Sri Rao Bahadur G. N. Rangaswami Ayyangar, Millets Specialist and Geneticist, for the encouragement he gave me to write up this short note.

The revised names are as follows:—

	Revised Names.	*Old Names.*
1.	Coix gigantea, Roxb.	Coix Lachryma—Jobi, Linn. var. gigantea, Stapf.
2.	Chionachne semiteres, C. E C. Fischer, n. comb.	Polytoca semiteres, Benth ex. Hook. f.
3.	C. Koenigii, Thw.	Polytoca barbata, Stapf. ex. Hook. f.
4.	Spinifex littoreus, Merr.	Spinifex squarrosus, Linn.
5.	Imperata cylindrica, Beauv.	Imperata arundinacea, Cyr.
6.	Saccharum ciliare, Anderss.	Saccharum arundinaceum, Retz.
7.	Dimeria avenacea, C. E. C. Fischer, n. comb.	Dimeria pusilla, Thw.
8.	D. Thwaitesii, Hack.	D. pusilla. Thw. var. pallida, Thw.
9.	D. tenera, Trin.	D. ornithopoda, Trin.
10.	D. Lawsoni, C. E. C. Fischer, n. comb.	D. pusilla. Thw. var. Lawsoni, Hook. f.
11.	Pogonatherum paniceum, Hack.	Pogonatherum saccharoideum Beauv.
12.	Eulalia quadrinervis, O. Ktz., var. Wightii, Hook. f.	Pollinia quadrinervis. Hack. var. Wightii, Hook. f.
13.	E. tristachya, O. Ktz.	P. argentea, Trin.
14.	E. phaeothrix, O. Ktz.	P. phaeothrix, Hack.
15.	Pseudopogonatherum contortum, A. Camus.	P. articulata, Trin.
16.	Microstegium ciliatum. A. Camus.	P. ciliata, Trin.
17.	M. nudum, A. Camus.	P. nuda, Trin.
18.	Pollinidium binatum, C. E. Hubbard.	Ischaemum angustifolium, Hack.
19.	Ischaemum aristatum, Linn.	I. ciliare, Retz.
20.	I. Thomsonianum, Stapf. MS., n. nom.	I. murinum. Hook. f. non Forst.
21.	I nilagiricum. Hack.	I. hirtum, Hook. f. non Hack.
22.	I. semisagittatum, Roxb.	I. conjugatum, Roxb.
23.	I. Rangacharianum, C. E. C. Fischer.	I. aristatum, Rang. et Tad. non Linn.
24.	I. mangaluricum, Stapf M. S. n. comb.	I. ,, Hook f. non Linn. var. mangaluricum, Hack.
25.	Sehima nervosum, Stapf.	I. laxum, R. Br.
26.	S. sulcatum, A. Camus.	I. sulcatum, Hack.
27.	Arthraxon echinatus, Hochst.	Arthraxon spathaceus, Hook. f.
28.	A. Quartinianus, Nash.	A. ciliaris, Beauv. a.
29.	A. hispidus, Makino	A. cilaris, Beauv. b.
30.	A. lancifolius, Hochst.	A. microphyllus, Hochst.
31.	Capillipedium glaucopsis, Stapf.	Andropogon assimilis, Steud.
32.	C. Huegelii, Stapf.	A. Huegelii, Hack.
33.	C. filiculmis, Stapf.	A. filiculmis. Hook. f.
34.	Amphilophis pertusa, Stapf.	A. pertusus, Willd.
35.	A. pseudoischaemum, C. E. C. Fischer, n. comb.	A. pseudoischaemum, Nees.
36.	A. Foulkesii. C. E. C. Fischer, n. comb.	A. Foulkesii, Hook. f.
37.	A. insculpta, Stapf.	A. pertusus, Willd. var. insculptus, Hack.
38.	A. Kuntzeana, Haines.	A. Kuntzeanus, Hack.
39.	A. glabra, Stapf.	A. intermedius, R. Br.
40	Vetiveria zizanioides, Nash.	A. squarrosus, Hack.

	Revised Names.	*Old Names.*
41.	Vetiveria Lawsoni, Blatter et McCann.	A. Lawsoni, Hook. f.
42.	Pseudosorghum fasciculare, A. Camus.	A. fascicularis, Roxb.
43.	Sorghum nitidum, Pers.	A. serratus, Thunb.
44.	S. Stapfii, C. E. C. Fischer n. comb.	A. Stapfii, Hook. f.
45.	S. halepense, Pers.	A. halepensis, Brot.
46.	S. durra, Stapf. var. coimbatoricum, Snow.	Andropogon Sorghum. Brot. Tam. *Periamanjal cholam*
47.	S. cernuum, Host var. globosum.	do. Tel. *Tella Jonna*,
48.	S. subglabrescens, Schweinf, et Aschers. var. compactam.	do. Tam. *Chinnamanjal cholam*
49.	S, subglabrescens, Schweinf, et Aschers. var. Irungiforme.	Tam. *Peria Vellai, Chitrai Vellai.* do.
50.	S. durra, Stapf. var. mediocre.	do. Tel. *Patcha jonna*
51.	S. Roxburghii Stapf. var. hians, stapf.	Tam. *Talaivirchan cholam.*
52.	S. dochna, var. irungu.	do. Tam. *Irungu cholam.*
53.	,, var. melliferum.	do. Tam. *Irungu cholam.*
54.	,, var. obovatum.	do. Tam. *Sen cholam.*
55.	Chrysopogon aciculatus, Trin.	A. aciculatus, Retz.
56.	C. asper, Heyne ex Hook. f.	A. asper, Heyne ex Hook. f.
57.	C. verticillatus, Trin.	A. verticillatus, Roxb.
58.	C. orientalis, A. Camus.	A. Wightianus, Steud.
59.	C. zeylanicus, Thw.	A. zeylanicus, Nees.
60.	C. montanus, Trin.	A. monticola, Schult.
61.	C. Hackelii, C. E. C. Fischer n. comb.	A. Hackelii, Hook. f,
62.	C. polyphyllus, Blatter et McCann.	A. polyphyllus, Hack. ex Hook. f.
63.	C. velutinus, Arn. ex Hook. f.	A. velutinus, Hook. f.
64.	Dichanthium annulatum, Stapf.	A. annulatus, Forsk.
65.	D. caricosum A. Camus.	A. caricosus, Linn.
66.	D. pallidum, Stapf. MS n. comb.	Apocopis pallida, Hook. f.
67.	D. nodosum, Willem.	Andropogon caricosus, Linn. var. mollicomus, Hack.
68.	D. polyptychum, A. Camus.	A. polyptychus, Steud.
69.	Heteropogon contortus, Beauv. ex Roem. et Schult.	A. contortus, Linn.
70.	H. polystachyos, Schult.	A. polystachyos, Roxb.
71.	H. oliganthus, Blatter et McCann.	A. oliganthus, Hochst.
72.	H. bellariensis, C. E. C. Fischer, n. comb.	A. bellariensis, Hack.
73.	Themeda triandra, Forsk.	Anthistiria imberbis, Retz.
74.	T. quadrivalvis, O. Ktz.	A. ciliata, Linn. f.
75.	T. laxa, Stapf ex Haines	A. laxa, Anderss.
76.	T. tremula, Hack.	A. tremula, Nees.
77.	T. cymbaria, Hack.	A. cymbaria, Roxb.
78.	Apluda aristata, Linn.	Apluda varia, Hack, sub sp. aristata, Hack.
79.	A. mutica, Linn.	A. varia, Hack sub-sp. mutica Hack.

	Revised Names.	*Old Names.*
80.	Eremopogon foveolatus, Stapf.	Andropogon foveolatus, Del.
81.	Schizachyrium brevifolium, Nees.	Schizachyrium brevifolius, Sw.
82.	S. exile, Stapf.	A. exilis, Hochst.
83.	Andropogon ascinodis, C. B. Clarke.	A. apricus, Hook. f. non-Trin.
84.	Cymbopogon Nardus, Rendle.	A. Nardus, Linn.
85.	C. flexuosus, Wats.	A. Nardus, Linn. var. flexuosus, Hack.
86.	C. confertiflorus, Stapf.	A. Nardus, Linn. var. nilagiricus, Hack.
87.	C. coloratus Stapf.	A. Nardus, Linn. var. coloratus Hook f.
88.	C. Martini, Wats.	A. Schoenanthus, Linn. var. Martini, Hook, f.
89.	C. caesius Stapf.	A. Schoenanthus, Linn, var. caesius, Hack.
90.	C. polyneuros, Stapf.	A. Schoenanthus, Linn. var. versicolor. Hack.
91.	C. Gidarba, Haines	A. Gidarba, Ham. ex. Hook, f.
92.	Hackelochloa granularis, O Ktz.	Manisuris granularis, Linn.
93.	Ophiuros exaltatus, . Ktz	Ophiuros corymbosus, Gaertn.
94.	Manisuris Myurus, Linn.	Rottboellia Myurus, Benth.
95.	M. acuminata, C. E. C. Fischer, n. comb.	„ acuminata, Hack.
96.	M. forficulata, C. E. C. Fischer.	„ divergens, Lisboa non—Hack.
97.	Mnesithea laevis, Kunth.	„ perforata, Roxb.
98.	Hemarthria compressa, Kunth.	„ compressa, Linn.
99.	Digitaria marginata, Link.	Digitaria sanguinalis, Scop, var extensum, Rang et Tad.
100.	D. marginata, var. fimbriata, Stapf.	„ sanguinalis, Scop. var. ciliaris Rang. et. Tad.
101.	D. Griffithii, Stapf.	„ sanguinalis, Scop. var. Griffithi, Rang. et. Tad.
102.	D. ternata, Stapf.	Paspalum ternatum, Hook. f.
103.	D. longiflora, Pers.	, longiflorum, Retz.
104	D. chinensis, Hornem.	„ „ Hook f. non—Retz.
105.	D. pedicellaris, Prain.	„ pedicellare, Trin.
106.	D. Royleana, Prain.	„ Royleanum, Nees.
107.	D. Wallichiana, Stapf.	„ Perrottetii, Hook.
108.	Alloteropsis cimicina, Stapf.	Axonopis cimnicius, Beauv.
109.	Pseudechinolaena polystachya, Stapf.	Panicum uncinatum, Raddi.
110.	Eriochloa procera, C. E. Hubbard.	Eriochloa polystachya, H. B. et K.
111.	Brachiaria distachya, Stapf.	Panicum distachyum, Linn.
112.	B. milliformis, Chase,	„ „ Linn.
113.	B. mutica, Stapf.	„ muticum, Forsk.
114.	B. eruciformis, Griseb.	„ Isachne, Roth.
115.	B. ramosa, Stapf.	„ ramosum, Linn.
116.	B. semiundulata, Stapf.	„ villosum, Lamk.
117.	B. semiverticillata, Alston.	P. semiverticillatum, Rottl.
118.	B remota, Haines.	P. remotum, Retz.
119.	B. Kurzii, A. Camus,	„ Kurzii, Hook. f.
120	Paspalum orbiculare, Forst.	Paspalum scrobiculatum, Linn.
121	P. vaginatum, SW.	„ distichum, Linn.
122.	P. longifolium, Rox.	, scrobiculatum, Linn.
123.	Stenotaphrum dimidiatum, Brogn.	Stenotaphrum glabrum, Trin.

	Revised Names.	*Old Names.*
124.	Paspalidium flavidum, A. Camus.	Panicum flavidum, Retz.
125	P. punctatum, Stapf.	„ punctatum, Burm.
126.	P. geminatum, Stapf.	„ paspaloides, Pers.
127.	Urochloa panicoides, Beauv.	, javanicum, Hook.
128	U. setigera, Stapf.	„ setigerum Retz.
129.	U. reptans, Stapf.	„ prostratum, Lamk.
130.	Echinochloa colona, Link.	„ colonum, Linn.
131.	E. colona, Link. var. frumentaceum.	„ Crusgalli, Link. var. frumentaceum, Hook f.
132.	E, crusgalli, Beauv.	„ Crusgalli, Linn.
133.	E. stagnina, Beauv.	„ „ Linn.
134.	Ottochloa nodosa, Dandy.	„ nodosum, Kunth.
135.	Holcolemma canaliculatum, Stapf. et. Hubb.	„ canaliculatum, Nees.
136.	Panicum oreades, Domin.	„ aequiglume, Hook. f. Non. Hack.
137.	P. paludosum, Roxb.	„ proliferum, Hook, f. Non-Lamk.
138	P. brevifolium, Linn.	„ ovalifolium, Poir.
139.	P. Gardneri, Thw.	Isachne Gardeneri, Benth.
140.	Hymenachne pseudo-interrupta, C. Muell.	Panicum Myurus, H. B. K.
141.	Cyrtococcum trigonum, A. Camus.	„ trigonum, Retz.
142.	C. oxyphyllum, Stapf.	„ pilipes, Nees et. Arn.
143.	C. patens, A. Camus.	„ patens, Linn.
144.	C. radicans, Stapf.	„ „ Linn.
145.	C. longipes, A. Camus.	„ longipes, W. et. A.
146.	C. sparsicomum, A. Camus.	„ sparsicomum, Nees.
147.	Saccolepis interrupta, Stapf.	„ interruptum, Willd.
148.	S. indica, Chase.	„ indicum, Linn.
149.	S. myosuroides A. Camus.	„ myosuroides, R. Br.
150.	S. curvata, Chase.	„ curvatum, Linn.
151.	Setaria palmifolia, Stapf.	„ plicatum, Lamk.
152.	S. pallidifusca Stapf. et. Hubb.	Setaria glauca, Beauv.
153.	Pseudoraphis aspera, Pilger.	Chamaeraphis spinescens, Poir.
154.	Rhynchelytrum villosum, Chiov.	Tricholaena Wightii, Nees.
155.	Pennisetum typhoides, Stapf. et. Hubb.	Pennisetum typhoideum, Rich.
156.	Cenchrus ciliaris, Linn.	„ cenchroides Rich.
157.	C. ciliaris, Linn. var. echionoides, Hook. f.	„ „ Rich. var. echionoides.
158.	C. setigerus, Vahl.	Cenchrus biflorus, Roxb.
159.	C. barbatus, Schum.	„ catharticus, Del.
160.	Thysanolaena maxima, O. Ktz	Thysanolaena Agrostis, Nees et Arn.
161.	Arundinella setosa, Trin.	Arundinella nervosa, Nees.
162.	A. pumila, Steud.	„ tenella, Nees.
163.	A. holcoides, Trin.	„ agrostoides, Trin.
164.	A. nepalensis, Trin.	„ brasiliensis, Hook. f. non Raddi.
165.	A. mutica, Nees.	„ capillars, Hook. f.
166.	Avenastrum asperum, C. E. C. Fischer, n. Comb.	Avena aspera, Munro.
167.	A. asperum var. schmidii, C. E. C. Fischer, n. Comb.	„ „ „ var. schmidii, Hook f.

	Revised Names.	*Old Names.*
168.	Venastrum var. polyneuron, C. E. C. Fischer. n. Comb.	Avena polyneura, Hook. f
169.	Coelachne perpusilla, Thw.	Coelachne pulchella, R. Br. var. gracillima, Hook. f.
170.	Neyraudia arundinacea, Henr.	Neyraudia madagascariensis, Hook. f.
171.	Aristida depressa, Retz.	Aristida adscencionis, Linn.
172.	Agrostis stolonifera, Linn.	Agrostis alba, Linn.
173.	A. pilosula, Trin.	Calamagrostis pilosula, Hook. f.
174.	A. Schmidii, C. E. C. Fischer n. Comb.	„ Schmidii, Hook. f.
175.	Garnotia scoparia, Stapf. ex. Hook. f.	Garnotia tenuiglumis, Stapf. ex. Hook. f.
176.	Trachys muricata, Steud.	Trachys mucronata, Pers.
177.	Tragus biflorus, Schult.	Tragus racemosus, Hook. f. non. All.
178.	Perotis indica, O. Ktz.	Perotis latifolia, Ait.
179.	Zoysia matrella, Merr.	Zoysia pungens, Willd.
180.	Demostachya bipinnata, Stapf.	Eragrostis cynosuroides, Beauv.
181.	Eragrostis spicata, Jedwabn.	Eragrostis phleoides, Stapf.
182.	E. riparia, Nees.	„ tenella, Roem, et. Sch. var. riparia, Stapf
183.	E viscosa, Trin	„ tenella, var. viscosa, Stapf.
184.	E. plumosa, Link.	„ „ var plumosa Stapf.
185.	E. japonica, Trin.	„ interrupta, Beav. var. tenuissima Stapf
186	E. diarrhena, Steud.	„ „ var. diarrhena, Stapf.
	„ var. Koenigii C. E. C. Fischer n. Comb.	„ „ var. Koenigii, Stapf.
187.	E. unioloides, Nees.	„ amabilis, W. et. A.
188.	E. gangetica, Steud.	„ elegantula, Steud.
189.	E. nutans, Nees.	„ stenophylla, Hochst.
190.	E. cilianensis, Link.	„ major, Host.
191.	E. poaeoides, Beauv.	„ minor, Host.
192.	E bifaria, Wight ex. Steud.	„ coromandeliana, Trin.
193.	Microchloa indica, Beauv	Microchloa setacea, R. Br
194.	Melanocenchris monoica, C. E. C. Fischer, n. Comb. non-O. Ktz	Gracilea mutans, Koen.
195.	M. Royleana, Nees.	G. Royleana, Hook.
196.	Enteropogon monostachyos, K. Schum.	Enteropogon melicoides, Nees.
197.	Cynodon dactylon, Pers. var. intermedius. C. E. C. Fischer n comb.	Cynodon intermedius, Rang et. Tad.
198.	Eleusine lagopoides, Merr.	Eleusine brevifolia, R. Br.
199.	Dactylotenium aegyptium, Beauv.	E. aegyptiaca, Desf.
200.	Dinebra retroflexa, Panz.	Dinebra arabica, Jacq.
201.	Enneapogon elegans, Stapf.	Pappophorum elegans, Nees.
202.	Elytrophorus spicatus, A. Camus.	Elytrophorus articulatus, Beauv.
203.	Aelurophus lagopoides, Trin. ex. Thw.	Aelurophus villosus, Trin.
204.	Oryza Meyriana, Baill.	Oryza granulata, Nees et. Arn.
205.	Anthoxanthum Hookeri, Rendle.	Hierochloa Hookeri, C. B. Clarke ex. Hook f.
206.	Vulpia Myuros, Gmel.	Festuca Myuros, Linn.

	Revised Names.	*Old Names.*
207.	Bromus catharticus, Vahl.	Bromus unioloides, H. B. K.
208.	Streptogyna gerontogea, Hook. f.	Streptogyna crinata, Thw.
209.	Triticum dicoccum, Schrank.	Triticum vulgare, Vill. F. B. I. VII. 367.
210.	Hordeum hexastichon, Linn.	Hordeum vulgare, Linn. var. hexastichon, Ait.
211.	Teinostachyum Beddomei, C. E. C Fischer, n nom.	Teinostachyum Wightii, Bedd.
212.	Oxytenanthera monadelpha, Alstom.	Oxytenanthera Thwaitesii, Munro.
213.	Ochlandra scriptoria, C. E. C. Fischer n. Comb.	Ochlandra Rheedii, Gamble.
214.	O. Wightii, C. E. C. Fischer, n. Comb.	„ Brandisii, Gamble.

Groundnut Oil-cake as Manure and Cattlefeed.*

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The international situation brought about by the present war has, among other things, affected the export trade of most of the countries of the world due to the closure of foreign markets resulting in an upset of agricultural economy. The situation is particularly embarassing to a country like India which is essentially a producer of raw materials entirely dependent upon other countries for the disposal of most of its agricultural produce. Of the many such products produced in the country on a large scale and marketed elsewhere groundnut figures prominently.

In spite of the offer of the United Kingdom to purchase all its requirements of oil seeds from India and attempts being made to explore new markets, the total production of groundnut in this country is bound to leave a surplus for which use has to be found. Restriction in area can be done only to a certain extent, for groundnut is a crop that is easily raised in the poor dry lands of the Province with little investment or care and is one of the few attractive crops for the dryland farmer. It becomes, therefore, necessary to absorb this anticipated excess production in the country itself by developing the Indian oil-seed crushing industry on a sound and planned basis and utilizing the oil and the residual cake *(poonac)*.

1. **Grades of groundnut poonac.** There are two grades of groundnut *poonac* recognised in trade and available in Madras. The one is the "expeller" quality and the other the "chekku" quality. The former is the residual matter left after the extraction of oil from the kernels, in power-driven oil mills or hand presses, while the latter is the residual cake left after the extraction of oil in the indigenous wooden *chekku* or *ghanni*. *Chekku* cake generally contains a little more of oil due to incomplete extraction and is consequently valued slightly higher than the expeller quality.

* Contribution No. 17 from the Oil Seeds Section of the Madras Department of Agriculture.

2. **Groundnut *poonac* as manure.** Groundnut *poonac* contains about 7 to 8 per cent of nitrogen and is considered a good organic nitrogenous fertilizer. Its manurial value compares very favourably with some of the other oil-seed cakes available in our country as can be seen from the following comparative figures of analysis.

	N	P_2O_5	K_2O
Groundnut cake	8·0	1·4	1·2
Castor cake	4·5	1·9	0·7
Coconut cake	3·4	1·5	1·3
Pungam *(Pongamia glabra)* cake	3·6	1·3	0·7
Neem cake	5·0	1·3	1·7

The use of groundnut *poonac* as a fertiliser for paddy and sugarcane crops is a well established practice in Madras. For sugarcane the *poonac* is particularly suitable and considered better than ammonium sulphate from the point of view of jaggery making and sugar refining. Experiments have shown that groundnut *poonac* at 400 to 600 lb. per acre to supply 30 to 40 lb. of N for paddy and at about a ton to supply 150 to 200 lb. of N per acre for sugarcane have given increased yields. In places where green manuring is not possible or practicable, groundnut *poonac* can be safely adopted as a manure for paddy. Taking the paddy crop into consideration even if 10 per cent of the total area of 10½ million acres under paddy takes to the application of groundnut *poonac* as manure, at the rate of 600 lb. per acre, it will easily account for a consumption of nearly 281,000 tons of the *poonac* in the Province itself. Again the total area of one lakh of acres under sugarcane in our Province can easily consume another one lakh tons of *poonac*. Thus there is a possibility of utilizing nearly 381,000 tons of groundnut *poonac* in Madras itself for manuring paddy and sugarcane alone not taking into account an appreciable quantity that can be used for crops like coffee, tea, oranges, plantains, vegetables etc. This extensive scheme of manuring if brought into operation will account for nearly 700,000 tons of groundnut kernels out of normal estimated production of 1,200,000 tons of shelled nuts in our presidency.

The chief impediment that hitherto stood in the way of its extended use was the high price the commodity commanded in the local markets during the pre-war period due to the large demand of groundnut kernels from foreign markets at attractive prices leaving only a limited quantity for crushing in the country. Moreover, ammonium sulphate with nearly 20 per cent nitrogen in an easily available form was then procurable at comparatively cheaper prices and proved attractive.

The absence of adequate export trade in groundnuts has brought about a marked decline in the prices of *poonac*. The current price-trend of groundnut *poonac* in the various markets in the Presidency has shown a fall of about 50—75 per cent from the pre-war level, making it at present a fertiliser definitely much cheaper (based on nitrogen content) than ammonium sulphate. In the appended statement the actual price of groundnut *poonac* per ton which existed before the outbreak of war and as it prevailed in

September 1940 is furnished in respect of the important groundnut crushing centres in the Presidency. It may be seen therefrom that the highest price of expeller groundnut *poonac* per ton is about Rs. 50 in Cuddalore (South Arcot) while in Vizagapatam, Guntur, Kurnool and Anantapur districts, the price is about Rs. 25 to Rs. 30 per ton. These prices are equivalent on the nitrogen basis to about Rs. 135 per ton of ammonium sulphate at Cuddalore and about Rs. 70 to Rs. 85 in the northern and central districts—prices which are far less per unit of nitrogen than even the pre-war prices of ammonium sulphate. With a further fall in the price of groundnut *poonac* which at the time of writing is about Rs. 16 per ton in several producing centres, it seems to be definitely economical to use the *poonac* as manure where-ever ammonium sulphate or other nitrogenous fertilizers were utilised before. It will not only supply the required quantity of nitrogen but, being an organic manure will also improve the soil texture. Moreover, groundnut is grown in almost all the districts of the Province barring perhaps the West Coast and the Nilgiris. This facilitates the crushing of the produce locally and using the *poonac* in the centres of production themselves without the necessity for large scale movements over long distances. This local sufficiency is likely to keep the price of *poonac* at reasonable levels due to the low cost of short-range transport.

Further, due to the war the availability of imported artificial fertilisers such as sulphate of ammonia, niciphos, ammophos etc., is very restricted. There is a great shrinkage in their imports, and attendent to lack of suitable transport facilities, future supplies are likely to be affected seriously. Prices have also soared and are still on the upward trend and may even become prohibitive. Ammonium sulphate, for example, which was selling at about Rs. 120 per ton in normal times is now being sold at Rs. 240 per ton subject to availability of stock. It is, therefore, expedient under existing conditions to bring into greater use in their place, a material like groundnut *poonac* which is locally available at economic rates.

Groundnut *poonac* as cattle feed. The importance of oil cakes as feed for work animals and milch cattle is widely recognised. Of the many sorts, groundnut *poonac* is perhaps the cheapest and the one very largely used, though preference is shown to gingelly *poonac* in some places for feeding milch cattle. It may be easily seen from the figures of analysis of the different oil-cakes furnished below that groundnut *poonac* is a rich source of protein and fat and is a useful concentrated feed.

				Carbo-hydrates		
	Moisture.	Ash.	Crude protein.	Crude fibre	Nitrogen free extract.	Fat.
Groundnut cake	10·7	4·9	47·6	5·1	23·7	8·0
Coconut cake	10·5	5·2	21·4	11·7	42·7	8·5
Gingelly cake	9·5	10·7	39·8	6·8	20·6	12·6

(From " Principles of Feeding Farm Animals " by Bull and Carroll)

Nutrition experiments conducted by the Government Agricultural Chemist, Coimbatore, have shown that groundnut *poonac* is a very healthy cattle feed and that there is no ground for the prejudice shown against it in some tracts. It has been determined that where paddy straw is used as roughage for feeding cattle about 14 oz. and where *cholam* (sorghum) straw is used about 4 oz. of groundnut *poonac* per day per head of cattle is a necessary maintenance ration if we are to improve the condition of our livestock and increase its efficiency and utility to us. Taking at the lowest level of 4 oz. per day, each head of cattle can consume about 90 lb. of *poonac* per annum. This ration at the present level of prices works out to only about a rupee per annum. Even if only about 25 per cent of the total estimated 17 million head of cattle in the Province is fed with the maintenance ration it could easily account for about 170,800 tons of groundnut *poonac*. Nearly four times or more of this quantity will be required when the question of feeding milch cattle or animals at work or those fed with the poorer bulk fodder like paddy straw is considered. Thus a drive in favour of the proper feeding of our cattle with groundnut *poonac* would appreciably enhance the utilization of more *poonac* and account for the local consumption of a good bit of the groundnut produced in the country and formerly exported. This would also improve the present impoverished condition of our cattle and indirectly increase the manurial value of the dung and result in the increased production of crops.

From the above statement of facts it can easily be seen that the only way to meet the difficult situation arising out of the lack of export trade in groundnuts is to utilise the produce in our country itself and to our great advantage remembering the fact that the foreign countries were purchasing this commodity at such high prices and transporting the stuff to long distances because they fully realised the value of the different products that can be obtained from this oil seed.

Current and prewar prices of groundnut cake—expeller quality.

Centre.	Prewar price.	Sept. 1940 price (per ton.)	Percentage fall	Calculated equivalent price of ammonium sulphate per ton based on current price of cake*
	Rs.	Rs.		Rs.
Anantapur district				
1. Pamidi, Gooty taluk	50 to 55	29	45	77·3
2. Hindupur	46	30	35	80
North Arcot District				
3. Tirupattur	58·2 to 62·7	39·2 to 40·3	34	106
South Arcot District				
4. Cuddalore	63·3	50·6	20	134 9
Bellary District				
5. Adoni	42 to 51	27·5	41	73·3
Coimbatore District				
6. Pollachi	67·2 to 71·7	35·8 to 38·1	47	98·5

Centre.	Prewar price.	Sept. 1940 price (per ton.)	Percentage fall.	Calculated equivalent price of ammonium sulphate per ton based on current price of cake*
Guntur District				
7. Guntur	53·8	44·8	17	119·5
8. Narasaraopet	53·8 to 58·2	26·9 to 29·1	50	74
9. Tenali	53·8 to 62·7	31·2 to 35·8	32	77·7
10. Ongole	44·8 to 53·8	34 7 to 38·1	26	97·1
Kistna district				
11. Bezwada	58·2 to 60·5	30·8 to 33·6	46	85·9
Kurnool district				
12. Kurnool	49·3 to 53·8	26·9 to 28	47	73·2
13. Nandyal	58·2	29·1	50	77·6
Tanjore district				
14. Pattukottai	49·3	45·9	7	122·4
Tinnevelly district				
15. Virudhunagar	58·2	49·3	15	131·5
Vizagapatam district				
16. Anakapalle	56	29·8	46	79 8
17. Vizianagaram	67 2	26·9	60	71·7

* Calculated on the basis of 7·5% of N in groundnut cake and 20% in ammonium sulphate.

SELECTED ARTICLE

Economic Factors in Agricultural Development.*

By K. C. RAMAKRISHNAN, M. A.

I. Economic Aims. Handicaps and Incentives. The ultimate aim of all agricultural development should be to ensure as high an income as possible for every worker on land, and not merely raise the yield per acre or secure a larger return on the capital invested. Comparisons are commonly made in agricultural publications of acreage yields of particular crops in different countries without reference to the diverse conditions, social as well as physical, in which they are produced. For instance, it is not so well known that in China, which is quoted for high yield per acre of rice and wheat, that the peasant had to sweat more than in any other country on his tiny holding, especially because of the lack of cattle power; and for manure he has to depend largely on night-soil. In Japan, again, which has next to Italy the highest yield of rice per acre, the tenant cultivator has not only to put in very hard work but he remains for ever in debt on account of the forced use of fertilisers at the behest of his money-lending landlord, and is often obliged to pay off the interest due by sending his children to toil in the small industries run by the same landlord. It is no doubt necessary in old settled countries, where scope for expansion of cultivation is limited and population is already pressing on the soil, that all efforts should be made to raise the yield per acre, if only as a means to raise it per worker. But it is necessary to reckon, in addition to items paid for in cash or kind, the human cost involved in such production. It is not altogether a matter for satisfaction

* *Substance of three Lectures delivered at the Agricultural College, Coimbatore, in November 1939 under the Maharaja of Travancore Curzon Endowment, University of Madras.*

that the Indian ryot "will struggle on patiently and uncomplainingly in the face of difficulties in a way that no one else could".

1 The fundamental handicap to the development of Indian agriculture is the smallness of most of the holdings, to which a parallel cannot be found in any western agricultural country. China and Japan alone have tinier farms. Hard work and ample manuring account for phenomenally high yields per acre in these two countries. In the newer lands of America and Australia where cultivation is extensive the yield per acre is low, but not the yield per worker. In Western Europe, where holdings are smaller than in America but bigger than in Asia, the yield per worker as per acre is high because of intensive cultivation an the efficiency of the former. It is only in India that the yield per acre as well as per man is low. Holdings are uneconomic and farmers are inefficient according to modern standards. Our holdings need to be enlarged as well as consolidated to become economic. It is a sign of the low standard that prevails in India that the common conception of an 'economic holding' is different from that which prevails elsewhere. A holding that provides substance for the farmer's family is called economic here, while among economists in the West an economic holding generally implies a holding that can fully engage the productive powers of the farmer and his family with the best available equipment. But whatever be the standard adopted, the optimum size of holding would vary with a number of factors: the nature of the crops, the conditions of soil, climate and water-supply, the capacity of cattle, the kind of equipment and the efficiency of the farmer; so that it is not easy to lay down a particular size under all conditions. Granting that the lower, subsistence standard is adopted and sizes are prescribed with reference to particular circumstances, it will not be easy in several provinces to secure even the minimum for the agriculturists who need it, unless perhaps the so-called 'cultivable' lands are all reclaimed. We have little precise data on the nature of these cultivable wastes, of the physical and economic difficulties in reclaiming them. Opinions are on the whole more pessimistic than optimistic. In a country with so much need for further land settlements, it is imperative that the State should set up an expert body to investigate and suggest ways and means of utilising these wastes and alloting them to farmers who show enough evidence of capacity to cultivate them, reserving for the State the power to resume them in case of bad cultivation.

2 Another evil commonly associated with small holding, but not exclusively confined to it, is the fragmentation of lands of the same holder. A revenue holding in Madras has been called "a conglomeration of fields and sub-divisions in a single village." The big holder has his holding as fragmented as the small one and makes little attempt to consolidate it. Most of the fragments are leased out to different tenants, the holder himself at best retaining a few acres for cultivation by farm servants. A case for fragmentation is often made out on grounds of diversity of soils and variety of water resources in one and the same village, which permit diversity of cropping and the spread of risks. But surely it would not be difficult to divide all the lands in a village into three or four blocks of arable land of different degrees of fertility or lying in different levels or irrigated by different systems. The re-allocation can be made in such a way that no holder need be refused any particular class of arable land of which he had owned a fragment, unless it was too small and it would be better to allot a compact holding of workable size in one block. No reformer desires to pool wet and dry and garden lands or pasture and wood lands. Every owner of plots in these lands is bound to carry on much better if he gets a compact field in each class of land. This is indeed the *sine qua non* of a number of agricultural improvements—of better animal husbandry in particular. In Europe the open field

system with scattered strips of holdings—where, however, a medley of crops in different stages of growth was not permitted as is done on our wet lands—has been doomed for over a century now, though its extinction seems to be a slow and painful process in some countries. The consolidation of fragmented holdings has been brought about in many countries by means of legislation which permitted and aided a majority in an area to have all the holdings properly restripped and allotted, even if a small minority was obstructive. The Punjab has succeeded in consolidating, by the more difficult co-operative methods, about a million acres. The Central Provinces more recently resorted, like European countries, to coercive legislation. Though the law has been enforced in only one Division, the area consolidated exceeds that of the Punjab, which has since enacted similar legislation, though it continues also co-operative methods. Co-operative consolidation is being tried in Madras, but with feeble results so far. Only about 500 acres have been consolidated, all in one district.

Even if the reform is brought about by coercive legislation, it should be realised that consolidation once effected cannot be proof against further subdivision and fragmentation, unless the law and custom of inheritance are changed and other avenues of employment are found for the future generation—whose numbers are bound to grow more and more in excess of the requirements of land judged by the trends in the growth of population on the one hand and the possible progress of agriculture on the other. In fact, in every country where agriculture has been held in high esteem, there is a striking shrinkage in the proportion of agricultural population to the total population in the last 50 or 60 years. For instance, the fall in France was from 52 to 40 per cent, in Germany from 42 to 30 per cent, in Denmark from 50 to 30 per cent, and in the United States it has gone down in the last 40 years from 33 to 22 per cent. The same has happened in Scandinavia and Netherlands and in Canada and Australia.

There is a fear that consolidation may mean more rural unemployment on account of the scope it may offer for the use of labour-saving machinery. This is likely; but it only shows up the waste of labour that has been going on. It is also possible, on the other hand that in a compact holding the scope for labour is widened by the digging of wells and lift irrigation or by the cultivation of more valuable crops demanding along with other things more labour per acre, e. g. sugarcane, plantains, Cambodia cotton, tobacco, fruit trees and vegetables and the production of milk—the demand for all of which is bound to grow with an increase in general prosperity.

In India with land so scarce, capital so shy and labour so abundant and cheap, the scope for the use of labour-saving machinery is limited in the vast majority of holdings, even if they be consolidated. There is a slowly growing demand for a few types of power machinery like the tractor plough, the oil engine or electric water lift, and the sugarcane crusher, which only the bigger landholders can afford to purchase. Even they do not want sowing or harvesting machinery. But the small holders can be encouraged to use less expensive labour-aiding or labour-improving implements like the mould-board iron plough the seed-drill and the bullock hoe, on dry soils in particular. It is also possible, if they co-operate, to buy or hire jointly and use in turns the costlier tractor-plough and the cane-crusher. There is little excuse, however, for even smaller farmers in scattered holdings failing to use the better seeds and adopt the methods of conservation of local manures recommended by the Department of Agriculture. The cost in either case is only a trifle higher, and it is the least expensive way of increasing the return from the land.

India though old in the art of agriculture is still an infant in the adoption of scientific ways of production and improved methods of economic organisation.

These are the means by which the European peasants have been repeatedly able to defer the operation of the law of diminishing returns on land. Indian cultivators have still to try so many known improvements in the art (rather the science) of agriculture, that the law of diminishing returns, whose ultimate validity may not be questioned by us, need not be a bug-bear now.

An important negative cause of the slow response of the Indian ryot to the efforts made by the scientists and other agricultural reformers is the lack of stimulus in India comparable to the severe competition felt by peasants of Western European countries in the seventies of the last century from the import of cheap grains from the virgin soil of America. It is this that drove them into new and more efficient lines of agricultural production and co-operative organisation. It is only in the last ten years, that is since the Depression began, that India has come to feel the effect of the growing competition, in foreign and even in home markets, from the tropical possessions of European States which have been most of them developed in the twentieth century. Whether the Depression has, on the whole, depressed more than it stimulated the Indian agriculturist, it is too early too say. But there are not wanting signs of an increased interest on the part of enterprising ryots in certain districts in the improvement of agriculture on modern lines. Strange as it may seem, it is in the proximity of industrial and commercial centres that the greatest progress has been made in the technique and organisation of agriculture.

A more rapid industrial development of India is desirable not only from the point of view of self-sufficiency of the country and an all-round efficiency of the people but also for the relief it will afford to land which is overcrowded and subjected to morselment by the increasing number of heirs. Not all new industries need be large or giant industries. Village industries might at first be adversely affected, but there would still be spheres in which small scale production would survive and supplement large scale manufactures, if aided by better tools and cheap electric power as in Japan. Not only the artisans, but agriculturists will stand to gain by the adoption of better tools and implements easily manufactured in industrial centres. More chemical manures (the by-product of heavy industries) and more organic manures (the refuse of populous cities) can be obtained for the benefit of agriculture. More capital, managerial ability and skilled labour are easier to procure in an industrial than in an essentially rural environment. Better business methods of credit, purchase, processing and sale are almost always available in urban areas and they can be slowly imbibed by rural folk in the neighbourhood. The market not only for the raw materials of industry but also for staple foodstuffs and agricultural specialities —in particular, fruits, vegetables, eggs, milk and ghee—is greater in a prosperous industrial community than in a predominantly agricultural society. But for the expansion of industries and the consequent widening of markets, there would have been little development of the dairy or any other intensive form of agriculture in Europe.

Let us not also forget that in Western countries like Germany, Italy and Ireland the impulse and inspiration for rural reconstruction came from leaders, who were not agriculturists but were products of urban civilisation, like Raiffeisen, Luzzatti and Horace Plunkett.

II. Co-operative Organization of Agriculture. It is a melancholy fact that after 35 years of working of the reorganised Departments of Agriculture in India the land under improved varieties is only a fraction of the total area under the particular crops. For instance, of rice and groundnut, the improved strains do not cover more than 5 per cent of the area under each, while of cotton the proportion is 20 per cent. A very important cause of the feeble response made by

the Indian ryots to the efforts of the Department is the lack of capital not only for permanent and substantial improvements but even for current cultivation expenses. In fact many of them have not the wherewithal to maintain their families some months after the harvest. The proceeds of the harvest are nearly exhausted in paying off the taxes and rates, in making part payments to creditors, and in buying long needed clothing and foodstuffs not grown on their own lands. All are not able to lay by enough grains and other food-stuffs grown on their very fields for the rest of the year. They sell them at a low price and later on purchase at a much higher price swelling thereby the profits of the merchants. A good harvest is a doubtful blessing as it only enables the money-lender to recover more of his dues.

Not even seeds are preserved for the next sowing by all. If they are, they are not carefully selected. There is either inadequate appreciation of the superior seeds evolved by the Department or inability to buy them. Inability to buy arises partly from lack of funds and partly from lack of such seeds near at hand. Any seeds stocked by merchants or money-lenders are purchased or borrowed at exorbitant rates. Ryots in some tracts have learnt to value superior strains like GEB 24 of paddy and Co2 of Cambodia cotton. But no agency, steady and reliable, has been organised to multiply those varieties and distribute them at reasonable rates, as trained nursery-men do in western countries. This is a work eminently fit to be undertaken by the agricultural graduates who hanker in vain for salaried service. Seed farms should be organised on co-operative lines in much larger numbers all over the country. A few stray farms here and there are hardly adequate.

The value of manures, even of chemical manures like sulphate of ammonia, not to speak of concentrates like oil-cakes and bonemeal, is well understood in many wet land and garden land tracts; but ryots suffer from a lack of credit facilities at reasonable rates free from any taint of exploitation, and from the absence of an organisation of their own which will supply these manures free from adulteration and at an economic price. That is why even South India, which is said to be more 'fertiliser-minded,' consumes so little of these manures.

Implements like iron ploughs, seed-drills and bullock-hoes are slowly getting into favour, specially where speed and thoroughness of cultivation are essential, as in the sugarcane and cotton tracts. And yet the number of implements actually sold in South India is far below the number that agricultural and industrial enthusiasts, like Sir A. Chatterton, expected. There is an important physical limitation in our province which makes the problem economically more difficult of solution. We have a variety of soils and climates that call for a variety of implements in different tracts. This hinders standardisation of implements and their manufacture on a large scale, which alone can reduce the costs of production and marketing and facilitate the supply of spare parts.

For over sixty years in Europe co-operative organisation has been considered to be the only means of salvation for petty peasants, as without it the economies realised by larger farms in securing credit, purchasing agricultural requirements, processing and selling produce could not be realised by the smaller farms—though in farming technique the small holders could at least hold their own with the bigger ones in certain lines of farming, e. g. dairy and poultry farming and the cultivation of fruits and vegetables. The supply of improved agricultural requirements was among the earliest type of co-operative services organised in Western Europe. One of the ways to meet the growing competition from the New World was to intensify cultivation by the use of better seeds, manures and implements. The supply of these at reasonable rates and free from fraud was best done by co-operative societies of producers. Another way to meet American

competition was to transform the system of agriculture into one of animal husbandry, the disposal of whose products in distant markets was very much facilitated by co-operative processing and marketing. In Germany though Raiffeisen began his experiments with credit societies, he urged them to undertake the supply of agricultural and domestic requisites, the processing and selling of members' produce and to promote the moral as well as material interest of members.

In India the Raiffeisen credit societies had dominated the field of co-operation for over 25 years and eclipsed all other forms of co-operative activity until recently. Yet not more than 25 per cent of the villages have been at all touched by co-operative credit. Even where the Raiffeisen system has spread, for all appearances, the working of the system has revealed a number of grave defects which are the subjects of enquiry by a committee. Over-dues have mounted up with no prospect of clearance in the near future. At least 25 per cent of the old societies will have to be liquidated at once. A New type of society may be tried in these and other villages.

A fatal flaw in the adaptation of the Raiffeisen credit system in India was that loans might be granted for unproductive, if necessary, as well as productive purposes. The rule was liberally interpreted and even ostensibly productive loans were utilised for the clearance of pressing prior debts, which could seldom be repaid within the stipulated period. It took more than a quarter of a century for those in charge of the movement to realise the need for a separate land mortgage banking system to finance long-term credit needs. Here again it is a matter for regret that our land mortgage banks have been so far doling out loans to clear off the prior debts of members, incurred generally for unproductive purposes, rather than helping them to effect permanent improvements on land or equip the farms with durable machinery. Provision has been recently made for loans for the sinking of wells, the installation of oil engines or electric plant for lifting water or crushing sugar-cane etc., but as yet little has been done. The demand for such loans does not easily come from the ryot. It is for the banks to take the initiative and educate the cultivator in the better use of long-term credit facilities. The Government has been for over 55 years offering what are known as Taqavi loans for permanent improvements; but for a variety of reasons, such loans are hardly popular with the ryots. Taqavi loans have also been granted for short term cultivation expenses, but not in normal years generally. The recent practice in Madras of entrusting the grant of such loans to the officers of the Agricultural instead of the Revenue Department is a welcome change.

Agricultural improvements have seldom constituted the real purpose of a co-operative loan, either short-term or long-term. So, whatever may be the technical success of some of our co-operative credit institutions from the purely financial point of view. it cannot be said that the earning capacity of our agriculturists has been increased.

In India rural credit societies, modelled as they were on Raiffeisen's, had among the objects provision for the supply of the agricultural and domestic requirements of members, the purchase and hire of machinery for the use of members, the sale of members' produce and the dissemination of the knowledge of the latest improvements in agriculture and handicrafts. This imposing array of aims was seldom taken up seriously, and there were not even a hundred out of 11,000 rural credit societies in the Madras Presidency that supplied or encouraged the use of improved agricultural implements, manure and seeds. The *ad hoc* supply societies were small and spasmodic in functioning. The Loan and Sale societies, of which they were more than a hundred, did supply some

improved seeds and manures. There were also a few Agricultural Improvement Societies that had supply as one of their functions and did business to the tune of Rs. 1·4 lakhs for the whole Presidency for a year. Other Provinces did not have a more creditable record in promoting agricultural improvements and supplying the requirements of modern agriculture. This is in striking contrast to the work done by co-operative societies in Western European countries and Japan. The Agricultural syndicates of France and the societies of peasants in Belgium, guided by the Catholic clergy, have done more to improve agriculture than departments of State. In Japan, though co-operative societies were not pioneers of new agriculture, 80 per cent of the 15,000 agricultural societies supplied seeds, fertilisers, implements, etc. to the tune of 70 million yen or Rs. 5 crores per annum—for a country with but 18 million acres of cultivated land.

Whether it is wise to separate supply from credit societies in view of the scare the enforcement of unlimited liability has created in the minds of well-to-do ryots or to stick to multi-purpose societies in view of the lack of human material to manage a variety of societies might be a moot point in India. But, whether alone or in combination, the supply of agricultural requirements was among the most important activities of co-operative societies in Europe and abroad. So powerful have some of the societies grown that in a number of countries they have through their wholesales taken up the manufacture of implements and manures and even the multiplication of seeds for distribution to members.

Marketing of agricultural produce in a raw condition was the most difficult and the latest of co-operative ventures to succeed in Europe. As long as produce was neither uniform nor graded and it met a local want, it was difficult to make a success of co-operative sale. Producers of better quality would not accept the same price as for inferior crops and it was difficult to pool produce of different members. The Society could not negotiate for a better price with uneven qualities and it was often left with unsaleable surpluses of members' produce. Production did not improve until a free and sure flow of surplus produce to the world's market was secured for the farmers. But the outside world would not care for produce that was not improved. This vicious circle was broken by leaders who organised at the same time co-operative sale and agricultural improvement.

Of all attempts at co-operative sale that have so far been made in India, the most successful are those of cotton sale societies particularly in Bombay and Madras—judged by the volume of sales and profits earned for producers. The success of these societies has depended largely on the response made by producers to the efforts of the Agricultural Department to spread improved strains of cotton. Some of them indeed started as seed societies, controlled and guided by the officers of the Department of Agriculture, who naturally strove to find buyers of the new cotton at higher prices than of the older varieties. Even after conversion into sale societies they did not give up the work of spreading new varieties, for which they received some subsidy from the Indian Central Cotton Committee. The Agricultural Officers supervised cultivation work and also graded and classified the cottons. Such graded cottons naturally commanded higher prices. They would not do so unless the varieties were very widely adopted and a large and steady supply of uniform quality were pouring into the market systematically. Small quantities offered by a few individual improvers could not withstand the competition or boycott of a ring of merchants Indeed such breakdown would be a setback to agricultural improvement in the tract. There is thus an intimate connection between co-operative sale and agricultural improvement.

Co-operative sale of milk is coming into prominence in the cities and large towns of India. The usual organisation is the milk supply union with its headquarters in or near the city to which are affiliated a number of societies in the neighbouring villages with members having cows or buffaloes, more often as a side line to agriculture. The milch cattle live under better conditions than in the congested city environment and the quality of milk is richer. But conditions of transport are far from satisfactory and pasteurisation of milk done at headquarters in the bigger unions is not as effective as it would be if conditions of transport and of handling in the initial stages in villages were better. The more serious handicap is the continuance of milch cattle in the city, which really ought to be shifted to rural tracts in their own interests as well as in the interest of public health. A great deal of improvement in the methods of breeding milch cattle and of growing fodder is necessary before the milk supply can be made a paying proposition for producers and brought within the reach of masses of poor consumers in our country. The help of a host of livestock and agricultural experts would be needed if the problem of milk supply should be satisfactorily tackled by co-operative organisations. Co-operative supply cannot for long compete with private suppliers and survive them without a vigorous programme of improvement of breeds and of fodder supply. This programme cannot be carried out in a country where the individual herd is so small without a co-operative organisation of producers Animal husbandry is bound to be a side line to the growing of cereal or other crops in most parts of the country and especially in wet land areas To be economic and to utilise the by-products of the farm, the individual herd must be small, especially where draught cattle have also to be maintained.

Outside India the most successful of agricultural co-operative societies is the society for production and sale, the earliest and the most typical of which is the co-operative creamery or dairy. The surplus milk in rural tracts, far removed from populous centres of consumption, is converted into butter and sold abroad by the butter export organisation which could bargain for the best price. The skimmed milk is returned to members for feeding the pigs kept for bacon production—invariably a by-industry in the dairy tract. Denmark was the earliest home of the co-operative dairy where all the butter produced was exported, through a bottle neck as it were, to Britain. Later on other countries in Europe and overseas have developed a formidable dairy industry mostly on co-operative lines. India, however, does not have any dairy society of the Danish model. Our demand is not for creamery butter but of ghee. Cold drawn creamy butter does not yield good ghee; it becomes waxy and does not have the grain or flavour of home-made ghee, and it does not keep like the latter.

The supply of pure ghee is far short of the demand and with the advent of hydrogenated and refined vegetable oils like Marvo, adulteration has become far too tempting. There is practically no pure ghee available in the urban or even in the larger rural markets. Ghee societies have been organised in the United Provinces which merely collect and sell the ghee made at home by individual members. It is doubtful whether with the best precautions of societies and even good intentions of members, genuine ghee can be collected and marketed. In our view large quantities of uniform, clean and pure product can be guaranteed only when ghee production becomes amenable to centralised manufacture as in the case of butter in Denmark. The Imperial Dairy Institute's method of making ghee by the use of citric acid is claimed to yield better and more ghee compared with the country method 'of natural souring.' Making of ghee direct from cream by heating it in a special boiler is also in the experimental stage. If these experiments are successful and good ghee can be made

on a large scale and use be found by propaganda and otherwise for all the skimmed milk and buttermilk—not so well relished now—the day will not be far distant when we may have a flourishing ghee industry more or less on the model of the Danish Co-operative Creamery.

There is a strong case for the co-operative manufacture of sugar or at least cream jaggery from sugarcane. South India is better fitted to grow the best varieties of cane than Northern India but it has a disproportionately small acreage under cane. A formidable obstacle to the expansion of the area is the difficulty of the disposal of cane after it is harvested. There are not enough factories to absorb the canes at a reasonable price. If it is too much for small farmers to establish a factory of their own on co-operative lines as at Vuyyur, it is up to them or to their well-wishers to organise smaller jaggery making societies with power crushers and improved furnaces. Not only would this reduce the cost of production of jaggery and thus stimulate the market for it, but it could help the producers concentrate their attention on cultivation.

There is ample scope, and from the point of view of agricultural improvement, great need. for the co-operative ginning and pressing of cotton and decortication of groundnut. Success in these lines has been demonstrated in Bombay and Madras. What is needed is further extension.

(To be continued).

ABSTRACTS

Methods for improving germination and final yield of cane. Mathur, R, N.— *Indian Sugar* 4 (1941): 22—26,

Germination of seed cane pre-soaked in limewash and water was respectively, 18 per cent and 20 per cent superior to the unsoaked cane at the time of early sowing of cane which at Shahjahanpur was done on February 9. In the case of middle and late plantings on March 7 and April 12, soaking in water gave no special advantage, Pre-soaking in limewash again gave better germination by 16 per cent in the middle and 8 per cent in the late sowing date. Final yield of millable cane was correspondingly better in the early sowing. An increase of 42 per cent was obtained when pre-soaking was done in water. No such increase was visible in the case of middle and late sowing dates with water. Soaking in limewash increased cane yield by 17 per cent in early, 20 per cent in middle and 24 per cent in the late sowing dates, respectively, on February 9th, March 7th and April 12th at Shahjahanpur. It is pointed out that where soil moisture is generally deficient as in an average cultivatior's field, pre-soaking should materially contribute towards a better germination and a better stand of the crop. If other conditions are favourable, proportionate increase in yield should also be expected. Seed cane called "good" derived from crop well supplied with nitrogen and water gives better germination and also germinates quicker than "poor" quality seed from crop starved of nitrogen and water. The improvement in germination was seen to be of the order of 8·5 per cent in early 13·7 per cent in middle and 6·9 per cent in the late sowing date. The number of shoots formed, yield of cane and of sugar follow a similar course. For the early, and middle sowing dates increase in cane yield of the order of 51·2 and 82·5 maunds per acre were obtained. No special advantage is derived when planting of "good" seed is delayed to April 12th under Shahjahanpur conditions. Attention is also drawn to the indirect disadvantage of a deficient supply of nitrogen and water to the crop, The "poor" crop thus raised, in turn, provides seed material of inferior quality which gives poor germination and poor yield. The advantage of harvesting earthed up cane deeper than generally practised, by

first dismantling the trenches, is clearly brought out by the data obtained. The loss of underground cane accruing from harvesting at the level of the ridges is approximately 6 per cent of the over ground cane and can be prevented by breaking up of the ridges before harvesting which permits of deeper cutting of cane. (Author's summary).

Soil and Water Conservation in the Southern Great Plains. By Hugh H. Bennet.—*Soil Science* 506: 435.

The co-operative accomplishments of farmers and technical men in Soil Conservation service work areas have proved once for all that soil erosion *can* be controlled if farmers have the will, the ingenuity, the energy and necessary knowledge to carry out the job. Permanent control of erosion involved the following methods: Conservation and more efficient use of rainfall. Recent climatic research indicates that neither ground cover nor lack of it has any appreciable effect on the amount and distribution of rainfall. The only sensible course is to increase the efficiency of rainfall through conservation and utilisation. Contour tillage, level terracing, strip cropping and basin listing help to hold rainfall on land and cover crops and crop residues serve to keep the ground surface open, absorptive and resistant to erosion. For the latter mentioned reason, establishing a vegetative cover is important. The chances of producing a successful crop are almost directly proportional to the amount of water in the soil at planting time. Evaporation of conserved moisture during hot summer is reflected in subsequent yields. In an experiment where (a) decayed straw ploughed in (b) fresh straw ploughed in (c) fresh straw disked (d) straw spread on ground and partially worked in, were the treatments, the last treatment was the best. In the case of basin-listing there was no run off but evaporation from surface tended to offset the gains of prevention of run off. The dunes are stabilised by spreading straw mulch over the entire area or by planting them to grass. Establishing wind breaks and adjusting flocks and herds to bearing capacity of soil are other methods to prevent erosion. The net result of erosion control and water conservation work has been a better diversified, more self sufficient and profitable type of Agriculture. S. V. P.

A New Economic Chemical for the Fruit Industry by H. E. Davis, *Agri. News Letter* 8: (1940).

In the field of fruit growing, insect and fungus attacks are common and their control is an active subject pursued by investigators. A different type of economic waste, namely that caused by the yearly fruitfall just at preharvest time is also well known Fruits which thus dropped were found to be free from insect or fungus attack. To avoid waste, farmers harvest apples and other fruits before they attained satisfactory size, maturity and colour. The United States Department of Agriculture interested itself in the new so-called hormone sprays in preventing such fruit fall. Two chemical compounds, viz., naphthalene acetic acid and naphthalene acetamide proved effective. So low a concentraction as 0·0005 to 0·001 per cent was found adequate. Sprays stronger than the above were found to "stick" the fruit so tightly that difficulty was often encountered in picking. These hormones are not readily soluble in water and so proprietary commercial preparations which dissolve readily in water are in the market. The effective period of the spray for most varieties of apples is from, two to three weeks. Because of the relatively brief period of effectiveness, it is important that application be delayed as long as possible preferably just prior to dropping or soon after its beginning in order to have the effect there when needed most. The material takes effect within one or two days after application. As a result of spraying no toxic effect or visible residue is noticed

nor is there any injury to fruit, foliage or tree. In the case of the fruit the only effect appears to be that of delaying drop thereby allowing for better colour development and some improvement in size. The author then refers to the use and cost of a proprietary product by name "Parmone" which the du Pont Company (Inc) Wilmington, Del., U. S. A., have put in the market.

(R. R.)

Gleanings.

The Soybean Crop in the United States. Production and processing of the soybean in the United States has grown to a multi-million-dollar industry. Today a ubiquitous plant, the soybean is useful as food for human consumption, feed for livestock and in manufacture of many useful goods. As a component in scores of manufactured products such as paints, soap, plastics, linoleum and waterproof materials, the soybean has gained an important place in the American industrial scene.

Forty-seven U. S. manufacturing establishments last year were engaged primarily in the production of soybean oil, cake and meal, according to the 1939 Census of Manufactures. In 1937, only 26 establishments were reported in this industry. The value of products of the soybean processing industry was $ 43,946,647, manufacturers reported to the Census Bureau, compared with the 1937 figure of 24,312,433, an increase of 80·8 per cent. The factories covered in the 1939 report gave employment to 1,481 wage-earners, who drew wages amounting to 1 889 457 and to salaried personnel numbering 199 who drew 663,469 in salaries.

The soybean first was introduced to American farmers in 1898. In 1909, the Census of Agriculture shows, this country produced only 16 835 bushels of soybeans. Cultivation was reported on 339 farms.

Twenty-five years later, in 1934, according to the latest available figures from the Census of Agriculture, the output had soared to 23,014,703 bushels, grown on 148,124 farms, and accounted for more than 25,000,000 cash income for farmers. A considerable part of this increase of more than a thousand-fold took place during the depression years, for production was only 8,661,188 bushels in 1929. In addition, the value of the crop used for livestock feed amounts to many millions of dollars more. According to the Department of Agriculture, the cash farm income from soybeans in 1937 was $ 28,030,000 and by 1938 it had risen to 31,933,000.

Soybean oil made from this Oriental immigrant to our farms is used primarily in shortening and oliomargarine. Of the 369,760,000 pounds of soybean oil consumed in American factories during 1939, census reports show that 201,599,000 pounds were used in the manufacture of shortening. Another 70,822,000 pounds became an ingredient of oleomargarine. The oil also is used in manufacturing candles, celluloid, core oil, disinfectants, electrical insulation, enamels; fuel. glycerin, insecticides linoleum, lubricants, oilcloth, paints, printing ink. rubber substitutes, varnish, waterproof goods and food products such as butter substitutes, cooking oil, lard substitutes and salad oils and medicinal oil. Lecithin is derived from soybean oil and is used as an emulsifier and in the manufacture of candies, chocolate, cocoa, margarine, medicines and in dyeing of textiles. (Egg yolk was the chief source before).

Dried soybean flour is used in baked products, breakfast foods, candies, diabetic foods, health drinks, ice-cream cones, ice-cream powder, infant foods, macaroni products and as filler in meat products. Soy sauce and sprouts are

produced from dried beans. Vegetable milk derived from soybeans is converted into casein, which is used in paints, size for paper, textile dressing and water-proofing. The meal is used for foods, fertilizers and manufacture of glue and celluloid substitutes.

More than a hundred named varieties of soybeans are grown in the United States, according to the Department of Agriculture. The cultivated soybean is derived from a variety which grows wild in Eastern Asia.

The first record of the plant is in the writings of Emperor Shang Nung of China in 2838 B. C. In Chinese mythology, it was first planted by Hou Tsi, one of the Chinese gods of agriculture, and has for centuries ranked as one of the five sacred grains necessary to Chinese civilization—perhaps one of the oldest crops grown by man.

Europe knew of soybeans in the seventeenth century, and they were tried in Germany, England, France and Hungary but were not commercially important until recent years. In 1898, the U S. Department of Agriculture began introducing soybeans on a considerable scale.

In the United States, the soybean is grown chiefly in the cornbelt states. Illinois, Indiana, Iowa, Missouri and Ohio lead. Manchuria is the biggest soybean producer in the world. Japan and South China rank high, too. In the Far East, foods based on the soybean supply the protein which is obtained from meats in the diet of western people. (*Science*, 93: No. 2404, pp. 86—87).

Research Notes.

An Abnormal Tobacco Plant.

During the course of our field observations tobacco plant with highly congested nodes, and leaves slightly reduced in size was first noticed in a local type (*natu* cigar type). The plant was found to possess nearly twice the number of leaves as its neighbours which is certainly a very desirable character, specially in tobacco, where the yield is in the form of leaf. The neighbouring plants were all topped, the usual practice in local tobacco cultivation, and this particular plant was allowed to grow without being topped. It is quite gratifying to note, that it continues to grow having given so far 120 leaves and though all other plants in the field have completed flowering and were harvested by the middle of March, this plant is still growing, without any signs of flowering. It has so far grown to a height of 8 feet, and vegetative buds from the leaf-axils are being fixed for cytogenetic studies. Detailed data regarding this plant in comparison with the normal, are being collected and further developments will be watched with care.

Agri. Res. Station, Guntur
May 1, 1941

R. Swami Rao,
M. P. Narasimha Rao,
M. Subrahmanyam.

Correspondence.

To

The Editor, Madras Agricultural Journal.

Paper from water hyacinth.

I wish to invite the attention of the readers to a very interesting article entitled, "Utilisation of Water Hyacinth in the manufacture of paper and pressed boards" by M. A. Azam, of the Industrial Research laboratory, Department of Industries, Bengal, Calcutta that has appeared in *Science and Culture* Vol. VI, No. 2, May 1941. It is of great interest to us in that Water Hyacinth (*Eichhornia crassipes*, Solms.) is becoming every day an increasingly important

Left: Abnormal tobacco plant.
Right: Normal plant of same age.

pest in South India as in other parts of the world. The readers of this Journal may well remember that when Mr. S. V. Ramamurty was Director of Agriculture, Madras, he rightly insisted on finding ways and means to utilise plants which could not be easily eradicated. Water hyacinth is one such, and the article referred to indicates an immense scope for the utilisation of this plant. As the author has pointed out, the utilisation of the plant would also mean the gradual and finally the ultimate eradication of this noxious weed. Among other things the author has been able to manufacture wrapping paper, writing paper, pressed boards and articles resembling the modern 'masonita' products. It is already known that water hyacinth could be employed as a good manure and I learnt that Messrs P. S. G. Sons Peelamedu, Coimbatore, have been wisely making use of it in this direction from the abundant material available on either side of the railway line between Coimbatore and Podanur. The article is worth the attention of Indian industrial magnates who would be in a position to start industries like paper-making from raw materials available in our own land, especially in the days of war, when importation of foreign articles is difficult.

Agricultural College and Research Institute, Coimbatore, Dated 22nd May 1941.

Yours etc.,

S. N. Chandrasekharan.

Review.

The Nutritive value of Indian foods and the planning of satisfactory diets. Health Bulletin No. 23. Manager of Publications, Delhi, 1939—Price annas 2.

Foodstuffs supply fuel for the body, and they contain proteins, fats, carbohydrates, vitamins and various mineral salts. Proteins, fats and carbohydrates are sometimes known as the energy-yielding food factors since they are "burnt" or oxidized in the body to provide the energy necessary for life. Vitamins and mineral salts do not supply energy in appreciable quantities but they play an important part in the physiological functions of the body.

2 **Total caloric requirements.** The minimum 'caloric' needs of an average Indian, engaged in ordinary easy-going agricultural or coolie work may be reckoned as 2,500—2,600 calories per day. Those who perform heavy manual work will probably require about 2,800 to 3,000 calories per day.

With the help of the tables furnished in the Bulletin, the caloric contents, etc., of diets can be worked out and compared with requirements as suggested.

3. **Daily requirements of food constituents.**

(a) *Protein.* This supplies building material for the body and makes good the loss of tissue and also supplies energy. Men and women of all ages ranging from 18 to 60, require 65 and 55 grammes per day respectively. All common food-stuffs contain protein but the amount they contain varies widely. Animal foods such as milk, eggs, fish and meat are rich in protein. The common cereals such as rice and millet, contain a fair proportion, rice being the poorest of all in this respect. The outer layers of the grain are richer in protein than the inner starchy kernel, hence the use of mill polished rice is not advocated. Among the vegetable foods, the pulses are richest in protein.

(b) *Fat.* It is advisable that not less than 45—60 grammes (1½—2 ozs.) should be consumed daily. Animal fats such as butter and ghee, contain vitamin A. Coconuts are rich in fat.

(c) *Carbo-hydrates.* These are the body's chief source of energy. Grain foods and root vegetables are largely composed of carbohydrates and sugar is wholly carbohydrate.

(d) *Mineral salts.* These are the elements which are most likely insufficiently supplied by average human diets.

(i) *Calcium.* This is found abundantly in whole milk, skimmed milk, butter milk and green leafy vegetables. Amaranth, (*Amaranthus spp*) fenugreek (*Trigonella foenum groecum*) and drumstick are rich in calcium. Rice is very deficient in calcium and there is evidence that insufficiency of calcium is one of the most important defects of the rice eater's diet. The daily requirement of calcium is 0·68 gramme per day per adult. The best source is milk. Green vegetables and ragi are particularly rich in calcium. The habit of chewing betel leaves coated with slaked lime, increases intake of calcium.

(ii) *Phosphorus.* More than 1·0 gramme should be daily supplied by the diet. Cereals in raw state are fairly rich but considerable loss of this element occurs on washing and cooking.

(iii) *Iron.* This is needed for blood formation. A well balanced diet should contain 20 mgs. per day.

(e) *Vitamins.*

(i) Vitamin A, is found in whole milk, curds, butter, pure ghee, egg, liver, fish, etc. While vegetable foods do not contain vitamin A, the pigment carotene (sometimes called provitamin A) which is present in many vegetables, appears to fulfil the physiological functions of vitamin A in the body. Leafy vegetables such as spinach, cabbage, amaranth leaves, coriander leaves, drumstick leaves and ripe fruits such as mangoes, papayya, tomatoes, oranges, etc., are rich in carotene. A well balanced diet should contain a daily minimum of 3,000 International units.

In the case of leafy vegetables, a good rough indication of carotene content is their greenness. The greener the better and the fresher the better. Ordinary cooking does not destroy the carotene present in vegetables.

(ii) *Vitamin B.* This is found in unmilled cereals, pulses, eggs, fruits, most vegetables, liver, meat and milk. Par-boiled rice, even when milled, contains this vitamin. The requirement of an adult may be estimated at 300 International units per day. The smaller the supply of vegetables, pulses and fruits, the more important it becomes to avoid a preponderance of 'milled' cereal in the diet. If rice is subjected to several washings, a large portion of this vitamin is lost. Milk which is a good source of most of the important food factors is not rich in vitamin B_1.

Vitamin B_2 (a term covering several vitamins) is an important food factor. All cereal foods are poor sources of it, milled rice being the poorest. Certain of the common pulses—Bengal gram, black gram and red gram, contain it fairly abundantly. Its richest sources are whole milk, skimmed milk, butter milk, curds, liver, eggs, green vegetables, pulses and lean meat.

(iii) Vitamin C is found in fresh fruits and vegetables. Pulses and cereals in the ordinary state do not contain it, but when they are allowed to sprout the vitamin is formed in grain and in green sprouts. The adult diet should contain 30—50 mgs per day. This vitamin is sensitive to heat and loss occurs in cooking.

(iv) *Vitamin D* is found in liver, egg, whole milk and ghee. The cheapest way of supplying is by exposing the body to sunlight.

4. **Effect of cooking on nutritive value.** Ordinary cooking causes loss of proteins, fats, carbohydrates in cereals, pulses and meat, in case of vegetables however there may be some loss when boiling particularly when salt is used.

During washing there is considerable loss of minerals. Frying does not lead to much change in the nutritive value. The addition of washing soda tends to promote vitamin destruction, while addition of tamarind has a preservative effect.

5. **Malnutrition.** The state of the skin is a sensitive index of faulty feeding: a rough dry skin or a skin covered with a papillary eruption suggests faulty feeding and in particular vitamin A deficiency.

This well got-up publication of 52 pages is perhaps the cheapest issued by the Govt. of India; but the fund of information contained in it is worth a hundred times the low figure of annas 2 at which it is priced. The possession of the publication and frequent reference to it for the planning of satisfactory diets in the home should be the aim of every housewife. To health workers, medical practitioners and managers of residential schools and other institutions, the book should prove a companion of inestimable value. The translation of the bulletin into the important languages of the country should be well worth the trouble taken to do it. M. K. R.

Imperial Council of Agricultural Research.

Annual Report for 1939 - 40.

The Agricultural Research Council's report for 1939—40 gives a review of the progress of agricultural research schemes undertaken during the year and in immediately preceding years. From the inception of the Agricultural Research Council it had solely to depend on annual discretionary grants from the Central Government. The financial position of the Council was thus quite insecure and it was not possible to plan and execute long term research programmes. To remedy this defect and to give the Council a stable financial footing the Government of India introduced in the Central Legislative Assembly, the Agricultural Produce Cess Act, in March 1940 which was duly passed and received the assent of the Governor-General. The Act provides for levying a cess of ½ per cent *ad valorem* on a number of agricultural exports. This will yield an income of about Rs. 14,00,000 in a normal year and the whole amount will be spent up in agricultural research schemes. The Council is thus ensured of a larger and more stable income unaffected by the financial vicissitudes of the Central Government.

The report deals with the activities in various centres in connection with the Council's rice research schemes. As a result of Sir John Russell's recommendation, the Council accepted the principle of limiting its assistance to work on rice genetics, water requirements and manurial experiments leaving rice breeding to be tackled by Provincial Governments. This policy has been generally followed. Efforts are being made in different parts of India to evolve varieties of rice suited to local conditions of growth, such as varieties which will stand salt, acid and flood, or would grow at an altitude of between 2000 and 5000 feet.

The preservation of fruits and vegetables by cold storage has received the attention of the Council for the last few years. In Bombay, cold storage trials have been made with practically all the important fruits and vegetables grown in India and their suitable cold storage temperatures have been ascertained.

Experiments on an American variety of tobacco, *Bonanza*, have shown that it is a suitable variety of cigarette tobacco for India. As decided by the Council in 1939 a tobacco officer was sent out for training in the United States of America, Canada, Japan, Singapore and Ceylon. Two other officers will be sent to U. S. A.. in 1941 for studying different aspects of tobacco cultivation viz, cultivation, curing, grading, re-drying and reconditioning, packing and storage etc.

The Council initiated a standardized pure-line trial of groundnuts at 27 different stations throughout India. Three new species of potatoes collected by

the Empire expedition to South Africa and Mexico were received in Simla and used for trials in this country.

Dry farming research throughout India is now being conducted on a common programme. The main line of work is agronomic, which will enable workers to evolve a system of farming capable of securing a crop even in a year of drought.

A large number of medicinal plants were chemically and pharmacologically analysed during the year and pyrethrum was tested for its value as an insecticide A monograph on the poisonous plants of India has been published. A large amount of information relating to the distribution of medicinal and poisonous plants has also been collected.

To give effect to the recommendations of Mr. A. Wilson, who was appointed by the Council to enquire into the prospects of increasing cinchona cultivation in India, the Council is considering a scheme of research providing for two research stations—one in the North and one in the South. To each of these stations a State nursery will be attached. These research stations will carry out a comprehensive programme of research and investigate the immediate problems of cultivation. The State nurseries will supply planting material to new concerns and test plots in selected areas will be laid out to determine the suitability of land for growing cinchona.

The central fodder and grazing committee of the Council considered during the year schemes on mixed farming from a few provinces and recommended a standard scheme capable of application throughout India, with modifications to suit local conditions.

A comprehensive scheme for an all-India soil survey is now under the consideration of the Imperial Council of Agricultural Research. The crops and soil wing of the Board of Agriculture and Animal Husbandry passed a comprehensive resolution for co-ordinated action in the provinces and States to check the menace of soil erosion in India.

The Council's bi-monthly Journal *Agriculture and Livestock in India* is appearing as a monthly magazine under a new title *Indian Farming* from January 1940. This magazine publishes the latest news of agricultural and veterinary research and new developments in theory and practice of farming. It aims to present a picture of research and developments in agriculture and animal husbandry in India. (*Science and Cultura* 6 (1941) : 574—575).

Crop and Trade Reports.

Statistics—Cotton—1940-41—Fifth or final report. The average of the areas under cotton in the Madras Province during the five years ending 1938-39 has represented 9·7 per cent of the total area under cotton in India.

The area under cotton in the Madras Province in 1940-41 is estimated at 2,390 600 acres as against 2,206,200 acres for the corresponding period of last year and 2,320 600 acres according to the forecast report issued in February. The present estimate for the Province represents an increase of 7·6 per cent as compared with the finally recorded area of 2,222,197 acres in 1939-40. The final estimate of last year fell short of the actuals by 0·7 per cent.

The increase in area in the current year as compared with the area in 1939-40 occurs in all the important cotton growing districts of the Province outside Kurnool, Nellore, Ramnad and Tinnevelly. The increase is marked in Guntur,

Anantapur, Cuddapah, Salem, Coimbatore (+98,300 acres) and Madura (+61,700 acres). The area estimated in respect of Coimbatore is the highest reported in recent years, whilst the area estimated in respect of Nellore is the lowest reported in recent years. Picking of cotton is in progress and may be finished in about a month. The crop was affected to some extent by the attacks of insects in Kistna, Guntur and Coimbatore and by heavy rains in Coimbatore, Ramnad and Tinnevelly.

Normal yield is expected in Vizagapatam, Chingleput, Chittoor, North Arcot, Salem, Trichinopoly (irrigated Cambodia only), Tanjore, Madura and South Kanara. A yield below normal is reported from the other districts of the Province. The estimated yield is very low in Tinnevelly (60 per cent for unirrigated cambodia and 63 per cent for irrigated cambodia, Kurnool (77 per cent) and Nellore (71 per cent).

The seasonal factor for the Province as a whole works out to 91 per cent of the average for both irrigated and unirrigated cotton, the corresponding figures according to the Season and Crop Report of last year being 92 and 94 per cent respectively. On this basis, the yield works out to 503,500 bales of 400 lbs. lint as against 455,390 bales of last year which represents an increase of 10·6 per cent. The yield in an average year is estimated at 545 630 bales. It is, however, too early to estimate the yield with accuracy as much will depend on future weather conditions and their effect on the second crop and on the amount of damage done by insect pests.

The estimated area and yield under the several varieties are given below :—

(Area in hundreds of acres, i.e. 00 being omitted; yield in hundred of bales of 400 lb. lint i.e. 00 being omitted.

Variety.	Area 1940–41 Acres.	Area 1939–40 Acres.	Corresponding yield. 1940–41 Bales.	Corresponding yield. 1939–40 Bales.
1	2	3	4	5
Irrigated Cambodia	2.726	1,785	1,572	883
Dry Cambodia	2,503	1 913	.502	338
Total, Cambodia ...	5,229	3,698	2,074	1,221
Uppam in the Central Districts ...	176	258	26	28
Nadam and Bourbon	264	251	13	6
Total, Salems ...	440	509	39	34
Tinnevellies*	7,047	7,093	1,592	1,575
White and Red Northerns	1,800	1,950	173	232
Westerns	8,170	7,660	957	948
Warangal and Cocanadas	1 135	1,072	189	189
Chinnapati (Short staple)	85	80	11	10
Province	23,906	22,062	5,035	4,209

* Includes Karuganni cotton in the Coimbatore district and Uppam, Karunganni and mixed country cotton grown in the South.

The table below gives final information so far as it is available on the crop of 1939—40.

(Figures in hundreds of bales of 400 lb. lint i. e. 00 being omitted).

Item	Particulars.	South		Deccan Northerns & Westerns.	Rest of the Province Cocanadas and others.	Total
		Tinnevellies and Salems	Cambodia.			
1.	Pressed at presses and loose cotton received at mills in 1940—41	1,531	2,148	1,396	344	5,419
2.	Subtract crop of 1938—39 pressed at presses and loose cotton received at mills in 1940—41 i. e. stocks of loose cotton held by the trade, ginneries, presses and mills on 31st January 1940	118	137	22	40	317
3.	Add loose cotton of the crop of 1939—40 held by the trade, ginneries, presses and mills on 31st January 1941	Information not available.				
4.	Add estimate of extra factory consumption	37	nil	38	25	100
5.	Total crop of 1939—40	1,450	2,011	1,412	329	5.202
6.	Yield as estimated in April 1940	1,631	2,074	1,130	200	5,035
7.	Yield as estimated in the Season and Crop Report of 1939—40	1,621	1,329	1,308	196	4,554

Note (1) The year 1940—41 relates to the period February 1940 to January 1941, when the crop of 1940—41 generally comes to the market. The early sown crop in the Deccan, however, generally comes into the market from December in each year. The figures are taken from the weekly returns furnished by mills and presses.

(2) Items (2) and (4)—The figures are approximate.

The average wholesale price of cotton lint per imperial maund of 82⅔ lb. equivalent to 3200 tolas as reported from important markets on 7th April 1941 was about Rs. 14—0—0 for Cocanadas, Rs. 17—6—0 for White Northerns, Rs. 18—2—0 for red Northerns, Rs. 13—9—0 for Westerns (Mungari crop), Rs. 20—13—0 for Westerns (Hingari crop), Rs. 32—13—0 for Coimbatore Cambodia, Rs. 29—15—0 for Southern Cambodia, Rs. 32—13—0 for Coimbatore Karunganni, Rs. 29—4—0 for Tinnevelly—Karunganni, Rs. 27—14—0 for Tinnevellies, and Rs. 26—4—0 for Nadam cotton. When compared with the prices published in the last report, i. e. those which prevailed on 3rd February 1941, these prices reveal a rise of 27 per cent in the case of Nadam, 22 per cent in the case of Coimbatore Karunganni, 19 per cent in the case of Westerns (Hingari crop), 16 per cent in the case of Tinnevelly Karunganni, 14 per cent in the case of Coimbatore Cambodia, 11 per cent in the case of Tinnevellies, 10 per cent in the case of red Northerns, 6 per cent in the case of Cocanadas, 4 per cent in the case of white—Northerns and 3 per cent in the case of Westerns (Mungari crop).

(Director of Industries and Commerce).

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st May 1941 amounted to 225,886 bales of 400 lb. lint as against an estimate of 503,500 bales of the total crop of 1940—41. The receipts in the corresponding period of the previous year were 222,392 bales. 218,162 bales mainly of pressed cotton were received at spinning mills and 21,332 bales were exported by sea while 85,963 bales were imported by sea mainly from Karachi and Bombay.

(Director of Agriculture, Madras).

College News and Notes.

The Entomological Society of India—South Indian Branch. A meeting of the Society was held on the 7th May 1941, when the following papers were read:—

1) Preliminary studies on the pollen-carrying capacity of the Indian bee by M. C. Cherian and S. Ramachandran and V. Mahadevan.

2) Description of a new species of *Trichospilus* parasitic on the pupae of the sugarcane moth borer—*Diatra venosata.*

3) *Apostocetus krishnaieri* Mani a new internal parasite of the Amaranthus stem borer weevil—Hypolixus truncatulus.

Eight interesting insect specimens were also presented.

Foot and mouth disease. Foot and mouth disease broke out among some of the animals in the Central Farm in the last week of April 1941. Stringent steps were taken to observe quarantine precautions The dairy herd was completely isolated and the area kept cordoned off from the farmyard. Only half the number of animals in the Farm were affected and the disease has subsided now. The dairy herd was affected with the disease and the disease is being allowed to run through the herd, the affected animals being given Chemio-therapy with iodine injections.

Personal. Sri K. Unnikrishna Menon, Senior Lecturer in Agriculture and Superintendent, Central Farm who is on 4 months leave preparatory to retirement handed over charge on 15—5—41 forenoon to Rao Bahadur Sri G. N. Rangaswami Ayyangar, Principal and Millets Specialist and Geneticist.

We are glad that Mr. R. C. Broadfoot who was on long leave for reasons of health has completely regained his health and has resumed his duties as Principal of the College, Senior Lecturer in Agriculture and Superintendent, Central Farm.

Consequent on the return of Mr. Broadfoot from leave, Rao Bahadur Sri G. N. Rangaswami Ayyangar, Principal and Millets Specialist and Geneticist who was granted four months leave, handed over charge of Principal and Senior Lecturer in Agriculture and Superintendent Central Farm to Mr. R. C. Broadfoot and that of Millets Specialist and Geneticist to Sri C. Vijayaraghavan on 24—5—41 afternoon.

Sri P. Abraham, B.A., M. Sc., Assistant to the Cotton Specialist who was permitted to enter foreign service for appointment as Scientific Officer to the Bombay Burmah Plantations Ltd., of South India, was entertained at dinner by the members of the Cotton Specialists section.

St. John's Ambulance Brigade. A Division called the Agricultural College and Research-Institute Division, Coimbatore was formed on the 8th May 1941 with Dr. K. Narayanan as Divisional Surgeon and Sri D. Natarajan as Divisional Superintendent. Ambulance classes are being held thrice a week. A second batch of 16 students commenced their training in "First Aid" on the 23rd April 1941 with Dr. K. Narayanan as Instructor and had their examination on 17th May 1941.

Visitors. Rao Bahadur K. T. Alwa and Dr. T. V. Ramakrishna Ayyar visited the Agricultural College in connection with the B. Sc., Ag. examinations.

Dr. P. K. Sen, Physiological Botanist, Fruit Research Station, Sabour, Biha and Sri K. C. Naik, Superintendent, Fruit Research Station, Kodur visited the Research Institute during the month.

UNIVERSITY OF MADRAS

B. Sc. Ag. Degree Examination—1941

LIST OF SUCCESSFUL CANDIDATES

First Examination. Dasaradhi, T. B; Devadas Kamath; Dhanvantari Reddi; Ganesan, K. R.; Gopalakrishna Sarma, M. V.; Govindaswami, C. V.; Krishnamurthi, C.; Krishnaswami, S.; Kuppuswami, B. S; Kuppuswami, K. P.; Kutumba Reddy, K.; Mirza Answer Baig.; Narasimhamurti, Y. V. S. S. S.; Narasimha Rao, I. L.; Narasimha Reddy, R.; Padaki, G. R.; Palaniswami, T. V.; Rajagopal Reddi, V,; Ramachandran, T. K.; Ramakrishna Sastri, K.; Rama Rao, V.; Ramesh Adyanthaya, N; Sridhara Sastri, D.; Srinivasan, C.; Subramanyan, R.; Sundara Rao, T. R.; Tiruvengadam, C. R.; Ummerkutti, O. V.; Venkataraman, T. M.; Venkataramanan, C. R; Prabhakara Reddy, G.; Suryanarayanamurti, K. V. S.

Second Examination. Adivi Reddy, A.; Anantakrishna Rao, P. N.; Dharmakkan Isaish.; Duraiswami, K. N.; Gurubasappa, H.; Krishnan, B. S.; Madhimaidas, V.; Nageshwara Rao, J. P.; Pitcheswara Rao, M.; Radhakrishna Reddi, A.; Raja Rao, K.; Ramakanta Reddy C.; Ramamohana Rao, K.; Ramanadham, S.; Sankara Rao, C.; Sethuraman, M. S.; Sivasubrahmanyan, P. K.; Srinivasa Rao, B.; Subba Raju, A.; Subrahmaniam Reddy, C.; Subrahmanyam, A.; Sundararajan, C. L.; Suryanarayana, K. S.; Suryaprakasa Rao, P. V.; Theophilus Chellappa.; Vijayaraghavan, K. S.; Yegneswara Chintamani, P.; Gopalakrishna Gokhale, V.*; Koulutlayya, M. C.; Narappa Reddi.; Santanaraman, T.; Vengala Rao, K. C.*; Venkateswara Chayanulu, U.*; Atchutarama Raju, I.; George, C. M.; Monappa Hedge, H.; Narayana Kamath, H.; Ramana Rao, D. V.; Somanna, K. M.; Thyagaram, U. V.

Final Examination. George C. M.; Monappa Hedge, H.; Narayana Kamath, H; Ramanamurthi, P. V.*; Somanna, K. M.; Thyagaram, U. V.; Bhaskara Reddy, N.; Chinnappa Reddi, D.; Daniel Sundararaj, D.; Hanumantha Rao, B.; Jagannathan, N.; Minakshisundaram, M. N.; Muhammad Ibrahim, P. A.; Narasimham, B.; Narasimhamurti, D.; Narayanan Nambiar, M.; Paramananda Panda; Rajagopalan, V. R.; Ramalingam, G.; Ramalingam, M.; Rama Rao, G.; Ramasubramanian, S. N.; Sanyasi Rao, U.; Seshavataram, B.; Shaukat Ali, K. A.; Sheenappa, K.; Srinivasan, N. V.; Srinivasan, S. T.; Srinivasan, S. V.; Srinivasalu, N.; Tiruvengalachari, T. K.; Vasudeva Rao, B.; Venkataramanamurti, C.; Venkateswara, P.; Venkateswara, T.; Mohan Punja, M.; Murti Raju, K.; Padmanabha Raju, B.; Raghavulu, G. V.

The following candidates have references in the subjects noted:—

Second Examination. *Engineering.* Subba Rao, K.; Mrutunjaya Sastri, R.; Thandavarayan, K,; Ramanamurthi, P. V.; *Animal Hygeine*, Anantakrishnan, N.; Jaganatha Rao, Y.; Krishnamurthi Rao, S.; Subramanyam, J.; Venkataramana Reddy, G.; *Agricultural Zoology.* Subba Rao, K,; Hanumantha Rao, K.; Kutumba Rao, V. V.; Syed Muhamad, D. A. *Agriculture Plant Husbandry.* Edward, J. J. D.; Ramaratnam, W. S.

Final Examination. *Agricultural Botany.* Achutarama Raju, I.; Ramana Rao D. V.; *Chemistry.* Narayanamurthy, R.; Sambamurthi, K.; *Agricultural Economic and Farm Management.* Narayanamurthi, R.; Radhakrishna Rao, D. and Sambamurthi, K.

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* Already passed B. Sc. Ag. final examination.

** Yet to pass one subject in the 2nd B. Sc. Ag.

Mofussil News.

Anakapalle. The annual honey day which was celebrated at the Agricultural Research Station on 4—4—41 was largely attended by the public of this place and the neighbouring ryots. Sri. D. Satyanarayana Raju Garu, Land-lord and Honorary Magistrate, Anakapalle, presided on the occasion. All the modern appliances for bee-keeping and a sample of honey extracted at the Station were exhibited. Sri K. Venkataraman in a brief speech in Telugu explained to the audience the advantages of bee-keeping and exhorted them to take to it as a subsidiary industry while Sri. D. V. Reddy gave a talk in English on bee-keeping as a cottage industry. An agricultural drama advocating improved methods of agriculture was also enacted on the occasion by the members of the Juvenile labour school of the Station. The audience evinced a keen interest in the proceedings of the evening and the function was a success.

K. V.

Atmakur. An Agricultural exhibition was held during the car festival of Sri. Ranganayaka Swami at Tartur from 10th to 14th April 1941. About 15,000 people mostly ryots from all over the District gathered here, of whom about 10,000 visited the exhibition. Improved strains of paddy, groundnut, Italian millet, sorghum, ragi and sugarcane. insecticides and fungicides for the control of crop pests and diseases and improved implements useful to the tract were exhibited.

B. R. R.

Bhadrachalam. A large scale exhibition was held at Bhadrachalam for the Sriramanavami Kalyana Mahostavam when thousands of pilgrims gathered from far and wide between the 4th and 8th April 1941. The important exhibits were chief varieties of paddy and rice of the Samalkota, Anakapalli and Maruteru Agricultural Research Stations, ragi varieties, earheads of E. C. 593 and *Poona Ganti* from Agricultural Research Station, Anakapalli; blocks of jaggery prepared from Co. 419 and Co. 421; cream jaggery; samples of *gangabondams* of Amalapuram; seed coconuts of Kasargode; plantain bunches of Samalkot; malt foods and biscuits sent by the Government Agricultural Chemist, bee hives, accessories and samples of honey, various labour saving implements, dusting and spraying machines and several charts and posters on agricultural subjects. One special feature of the exhibition was the poultry section where White Leghorns and Rhode Island Reds popularised through the efforts of the Agricultural Demonstrator. Specimens of Co. 419 cane and silage prepared locally were also exhibited.

T. R.

Bhimavaram. The Andhra Cultural Conference and the Swadesi Industries exhibition was arranged by the Secretary of the East Godavari District Commercial Museum in the newly constructed museum buildings to synchronise with Sreeramanavami festival. Agricultural and other exhibitions were arranged in specially constructed sheds. Exhibits from Kodur Fruit Research Station, and those put up by the Chemistry, Entomology and Mycology crops and bee-keeping sections and implements of Messrs. P. S. G. & Sons, Coimbatore gave prominence to the whole show and thousands of visitors had the opportunity of seeing the several demonstrations. It is interesting to note that the practical demonstration conducted by Sri. M. Suryanarayana, Assistant in Chemistry, Coimbatore, in the manufacture of cholam malt attracted many visitors.

On the 14th April in connection with the Andhra Cultural Conference an Agriculturists' conference was held under the presidentship of the Maharaja of Jeypur in the Vikrama hall of the building. Sri. T. Lakshmipati Rao, Agricultural Demonstrator, Bhimavaram, spoke on 'Better methods of agricultural

propaganda'. Sri. M. Suryanarayana, Assistant to the Agricultural Chemist delivered a lecture on the preparation of cholam malt.

The president, said that the suggestion given by the lecturers in carrying on agricultural propaganda with the aid of poets, *Bhagavathars* etc. by singing the folk songs and producing suitable gramaphone records would be successful and easy and the ryots should co-operate and help the propagandists Unless agriculture was well developed, there would be no possibility for developing any industry. He advised all to take up cholam malt manufacture as a cottage industry and to use the same in place of foreign foods. T. L. R.

Mannargudi. An agricultural exhibition was held in connection with the 'Vennaithali festival' at Mannargudi from the 26th March to 2nd April 1941. Besides the usual paddy, rice and oil seeds samples and improved ploughs and other implements recommended to the rice growers, specimen plots of different varieties of green manure and fodder crops and an attractive display of citrus fruits, vegetables and potato varieties formed a special feature of the exhibition. The other exhibits included different breeds of poultry, bee hives and bee-keeping appliances, varieties of sugarcane, mango grafts and budded citrus varieties malt foods and canned fruits. The exhibition attracted large crowds daily and the different exhibits were explained to them Lantern lectures were given on improved methods of agriculture. About 5000 people visited the exhibition stall. At the close of the show, there was a rush for the purchase of many exhibits which included vegetable seeds, pine apple fruits, green vegetables, orange and mango grafts and honey. M. A.

Trithala. A Rural exhibition was held at Trithala under the auspices of Trithala multi-purpose Cooperative Society on 22nd and 23rd March 1941. The exhibition was opened by Sri. K. Unnikrishna Menon, Senior Lecturer in Agriculture and Superintendent, Central Farm, Coimbatore. Stalls were separately opened by the Agriculture, Veterinary Health and Cooperative Departments. A number of ryots from surrounding villages attended the show. Ploughing competitions for labourers, and spinning and elocution competitions for students of the neighbouring schools were an important adjunct to the show. Sports by the school children as well as by elders were other items on the programme. The judges appointed by the Exhibition committee made visits to ryots' lands and inspected *in situ* the improvements adopted in their fields for awarding prizes. Meetings were held and lectures were delivered on various subjects pertaining to agriculture veterinary science, health, cooperation, cottage industries. The Agricultural Departmental stall was arranged tastefully with a liberal complement of coloured pictorial and world posters. The visitors evinced considerable interest in the Pattambi and Taliparamba strains of paddy and other specimens of seeds and graft plants, grasses and silage. Bee keeping and insect pests and diseases of paddy, coconut, arecanut and other important crops formed a separate section in the stall. Practical demonstrations with improved implements in the neighbouring fields held during the period attracted a large crowd. A large number of prizes were offered for which there was keen competition.

Social. A very pleasant farewell party was arranged at the Agricultural Reserch station, Guntur on the afternoon of the 8th April to bid farewell to Sri. S. V. Doraiswami Iyer, Farm Manager on the eve of his transfer to Coimbatore. Sri. M. Narasimham, Demonstrator, Guntur on transfer to Tenali, and Sri. Mukundarao, and Sri. Muthuswami Achari to the office of the District Agricultural Officer, Chittoor. Besides several of District officers from Guntur and Krishna districts Messrs. R. Swami Rao, S. Sitaram Patrudu and L. Narasimhachari were also present. B. S. M.

Weather Review—APRIL 1941.

RAINFALL DATA

Division	Station.	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·6	–0·2	0·8
	Calingapatam	0·0	–0·9	0·4
	Vizagapatam	0·0	–0·7	2·7
	Anakapalli *	0·7	–0·2	2·9
	Samalkota*			
	Maruteru*	0·0	–0·5	0·2
	Cocanada	0·0	–0·6	1·7
	Masulipatam	0·0	–0·6	0·1
	Guntur*	0·0	–0·7	0·1
Ceded Dists.	Kurnool	0·2	–0·4	0·3
	Nandyal*	0·4	–0·6	1·0
	Hagari *	0·8	–0·2	1·1
	Siruguppa*	0·2	–0·8	2·6
	Bellary	1·2	+0·4	1·9
	Anantapur	0·0	–0·5	0·8
	Rentachintala	0·0		0·5
	Cuddapah	0·9	+0·4	1·7
	Anantharajupet *	0·0	–1·4	1·1
Carnatic	Nellore	0·0	–0·4	0·2
	Madras	0·2	–0·3	0·9
	Palur*	0·7	–0·7	3·4
	Tindivanam *	0·1	–1·0	1·4
	Cuddalore	1·2	+0·6	5·5
Central	Vellore	0·0	–1·0	0·5
	Gudiyattam*	0·0	–0·8	0·6
	Salem	2·5	+0·7	2·6
	Coimbatore	2·3	+0·9	3·1
	Coimbatore A. C. & R. I.*	1·7	–0·2	3·1
	Trichinopoly	1·1	–0·6	1·3

Division	Station	Actual for month	Departure from normal @	Total since 1st Janaruy
South	Negapatam	0·9	+0·3	4·7
	Aduthurai *	2·3	+0·7	4·1
	Madura	7·7	+5·7	9·1
	Pamban	0·6	–1·0	7·9
	Koilpatti*	2·1	–1·0	3·8
	Palamkottah	4·9	+2·4	6·3
West Coast	Trivandrum	3·1	–1·5	5·8
	Cochin	2·9	–1·8	4·9
	Calicut	2·6	–0·7	3·2
	Pattambi *	1·6	–2·1	1·6
	Taliparamba *	2·5	–10·5	1·6
	Kasargode *	1·7	–1·2	1·7
	Nileshwar*	2·6	+0·8	2·8
	Mangalore	0·1	–0·2	0·1
Mysore and Coorg	Chitaldrug	0·8	–0·1	1·0
	Bangalore	3·2	+1·9	3·4
	Mysore	5·2	+2·9	5·3
	Mercara	3·0	+0·4	3·2
Hills	Kodaikanal	3·0	–1·3	7·5
	Coonoor			
	Ootacamund *	1·9	–2·1	3·2
	Nanjanad *	3·0	–0·2	4·0

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated up to 1937 (published in Fort St. George Gazette).

Weather Review for April 1941.

The weather at the beginning of the month was characterised by high temperatures, but between the 10th and 15th the passage of a low pressure wave over the south of the peninsula occasioned widespread thunderstorms and rain in the south of the peninsula. The activity of the low pressure wave was most marked between the 10th and 12th. Thereafter, hot weather conditions set in over the peninsula with high day temperatures and scattered thunderstorms. Temperatures rose about the middle of the month and were generally appreciably above normal over the central parts of the country, the highest maximum temperature recorded being 115° at Rentichintala on the 30th of the month when temperatures were appreciably above the average over the whole of India ranging from +16° in South West Punjab and Sind to 4°—8° over the peninsula.

Rainfall for the month was in excess in the southern districts and locally in the Central Districts, Mysore and Coorg and generally in defect elsewhere.

The chief falls reported were:

(i) Madura 5·1″ (12th).
(ii) Palamkottah 4·5″ (10th).

Weather Report for the Agricultural College and Research Institute Observatory.

Report No. 4/41.

Absolute maximum in shade	...	99·5°F
Absolute minimum in shade	...	70·8°F
Mean maximum in shade	...	96·6°F
Departure from normal	...	+1·0°F
Mean minimum in shade	...	75·0°F
Departure from normal	...	+1 9°F
Total rainfall for the month	...	1·65″
Departure from normal	...	−0·23″
Heaviest fall in 24 hours	...	1·01″ on 11th
Total number of rainy days	...	2
Mean daily wind velocity	...	1·20 m. p. h.
Departure from normal	...	−1·43 m p. h.
Mean humidity at 8 hours	...	68·7%
Departure from normal	...	−2·4%

Summary. The weather during the month was generally dry except for the period between 10th and 15th when rain was received during the passage of the low pressure area across the south of the peninsula. Day temperature was slightly above normal while the night temperature was appreciably above normal. The total rainfall was in slight defect. P. V. R. & S. V. K.

Departmental Notifications.

Gazetted Services.

1. Appointment.

Sri C. Jagannatha Rao, Assistant in cotton section, Agricultural Research Station, Nandyal, is appointed to officiate as Gazetted Assistant, Mungari Cotton Scheme, Adoni on a pay of Rs. 190 per mensem in category 7 Class I, Madras Agricultural Service Vice Sri V. K. Subrahmanya Mudaliar granted leave.

Subordinate Services.

Appointments.

The services of Sri M. B. Venkatanarasinga Rao, permanent Assistant, Paddy section, Agricultural Research Station, Maruteru, are placed at the disposal of the Government of India for appointment as temporary Assistant under the Imperial Council of Agricultural Research in connection with the scheme far the preparation of a monograph on "Rice Breeding and Genetics in India" for a period of 18 months.

Sri K. Satyanarayana Murthi, Probationer in category i class I Madras Agricultural Subordinate Service, who has been discharged for want of a vacancy is reappointed as Officiating Upper Subordinate, Science Section and is posted to officiate as Cotton Assistant in the Mungari Cotton Scheme, Adoni, *Vice* Sri N. G. Narayana granted leave.

Sri S. Lakshminarayana Pantulu, probationer who has been discharged for want of vacancy is reappointed to officiate as Upper Subordinate, Agricultural Section and is posted as Agricultural Demonstrator, Pattikonda *Vice* Sri N. Ranganathachari transferred.

P. Abraham, Assistant to the Cotton Specialist has been permitted to enter foreign service for appointment as Scientific Officer to the Bombay Burmah Plantations Ltd.

Transfers.

Name of officers.	From	To
Sri M. Gopalan Unnithan,	A. D., Tirupattur	
,, P. Nagadhara Nayudu,	Asst. A. D., Nandyal	F. M., A. R. S., Nandyal.
,, V. Kurma Rao,	A. D., Repalle	A. D., Vuyyur Factory.
,, S. L. Narasimha Rao,	Asst. A. D., Vuyyur	A. D., Repalle.
,, C. V. Sundaram Ayyar,	Asst. in Entomology, Coimbatore	A. R. S., Aduthurai.
,, S. Madhava Rao.	F. M, Central Farm, Coimbatore	F. M., G. B. G and Park, Ootacamund.
,, K. Krishna Hegde,	Asst. F. M., G. B. G. and Park, Ootacamund	F. M., Nanjanad.
,, K. Govindan Nambiar,	F. M., A. R. S, Nanjanad	F. M., C. F., Coimbatore.
,, T. K. Thangavelu,	A. D, Ootacamund	A. D., Avanashi.
,, K. H. Subrahmania Ayyar,	A. D., Avanashi	A. D., Ootacamund.

Leave.

Name of officers.	Period of leave.
Sri C. S. Sankaranarayana Ayyar, A. D., (on leave)	Extension of L. a. p. for 1 month from 22--5—41.
,, B. Sivarao, A. D., Tuni,	Extension of L. a. p. on m. c. for 4 months from 5--4—41.
,, P. Lakshminarayana, A. D., Chodavarm,	L. a. p. on m. c. for 3 months from 30—4-41
,, N. Sobhanadri, Supdtt. Market Yard Committee, Guntur,	L. a. p. for 90 days from 1—4—41.
,, J. David, Asst. A. D., in Mycology Coimbatore,	L. a. p. for 2 months from 21—5—41.
,, S. Varisai Muhammed Sahib, Asst. in Oil Seeds. A. R. S., Tindivanam,	L. a. p. for 30 days from 6—5—41.
,, G. Narasimhamurthi, F. M., A. R. S., Siruguppa,	Extension of L. a. p. for 30 days from 16—5—41.
,, N. Ranganathachari, A. D., Done,	L. a. p. for 42 days from 4—4—41,
Janab A. Gulam Ahmed Sahib F. M., A. R. S., Koilpatti,	Extension of L. a. p. for 1 month on m. c. from 7—5—41.
Sri K. G. S. Bhandari, A D. Coondapur,	L. a. p. for 1 month from 5—5—41.
,, C. S. Balasubrahmanya Ayyar, Asst. in Entomology, Cuddapah,	L. a. p. for 2 months from 3—5—41.
,, V. Krishnaswami, Asst. A. R. S., Aduthurai,	L. a. p, for 1 month and 10 days from 5—5—41.
,, M. Ratnavelu, A. D., Bhavani,	L. a. p. for 3 months from 7—5-41.
,, V. Karunakaran Nair, Dairy Manager, Coimbatore,	L. a. p. for 1 month and 10 days from 22nd May 1941,
,, M. Gopalan Unnithan, A. D., Tirupattur.	Extension of L. a. p. for 1 month from 16—5—41.

Applicability of the Agricultural Produce (Grading and Marketing) Act to Sann Hemp.

G. O. Ms. No. 829, DEVELOPMENT DATED MAY 2, 1941,

No. F. 3—9 (3)/41—A. In exercise of the powers conferred by section 6 of the Agricultural Produce (Grading and Marketing) Act, 1937 (I of 1937), the Central Government is pleased to direct that the provisions of the said Act shall apply to the following article of agricultural produce, namely *Sann Hemp.*

—*Ft. St. George Gazette.*

UNIVERSITY OF MADRAS

B. Sc. (Agriculture) Degree Examination, April 1941.

FIRST EXAMINATION

Three hours] AGRICULTURE [60 marks.

Answer six *questions only.* Questions 1 and 2 are compulsory.

1. What are the factors that decide the agricultural seasons in a tract? Explain this with reference to the Coimbatore district. (12 marks)

2. Write short notes on :— (*a*) Black soil of Bellary. (*b*) Red soil of Malabar, and (*c*) Delta soil of Tanjore. (12 marks)

3. What is the importance of soil temperature to plant growth? Explain the methods by which this temperature can be raised. (9 marks)

4. What is the object of tillage? How can good tilth be obtained in a dryland field? (9 marks)

5. The method of farming adopted in the West Coast requires fewer tillage implements than those required in the Ceded Districts. Why? (9 marks)

6. Differentiate between 'preparatory cultivation' and 'after cultivation'. Give examples of after cultivation followed in wet, garden and dryland cropping. (9 marks)

7. Write short notes on one improved implement used in each of the following operations :— (*a*) ploughing. (*b*) sowing. (*e*) inter-cultivation. (9 marks)

8. A farmer possesses country and Cooper No. 11 ploughs. For what operations would you recommend these different kinds of ploughs in wet, garden and dry-land cultivations, giving reasons for your recommendation. (9 marks)

Three hours.] BOTANY [60 Marks.

Answer six *questions only.* Questions 3 and 6 are compulsory.

1. Give an account of the modifications seen in roots for performing functions other than fixation in the earth and absorption of materials therefrom. (9 marks)

2. What are the following? Give one example for each and explain the structure by means of drawings :—

Syconium, Caryopsis, Pome, Silique, Loculicidal capsule, Achene. (9 marks)

3. Give a full botanical description of any grass that you have examined and summarise the characters of the family Gramineae. Mention the popular and botanical names of important plants of this family growing in South India. (12 marks)

4. What tissues contribute to rigidity in plants? Explain with sketches how and on what principles they are distributed in the plant organs. (9 marks)

5. Describe the structure of a typical ripe anther and state how the pollen grains are formed in it. Draw figures to illustrate your answer. (9 marks)

6. What are the factors concerned in photosynthesis? How will you demonstrate their necessity by means of simple experiments? (12 marks)

7. What are enzymes? Mention the different kinds and state how they act and help the plant in all its metabolic activities. (9 marks)

8. State briefly what you understand by the following terms:—

a) water requirements of plants, *b*) intramolecular respiration, *c*) negative geotropism. (9 marks)

Three hours.] CHEMISTRY [60 marks.

CHEMISTRY

Answer six *questions only.* Questions 4 and 5 are cumpulsory.

1. Explain the terms:— (*a*) Elementary qualitative analysis, and (*b*) Identification of an organic compound. In what essential respect does qualitative organic analysis differ from qualitative inorganic analysis? (9 marks)

2. Describe Kjeldahl's method for the estimation of nitrogen in organic compounds.

0·5 gm. of groundnut cake was used in an experiment. The distillate was received in an Erlenmeyer flask containing 10 c.c. of semi-normal sulphuric acid, 27·5 c.c. of deci-normal potassium hydroxide were required to neutralise the excess acid. Calculate the percentage of Nitrogen in the sample of cake.

1 c.c. of deci-normal sulphuric acid = 0·0014 gm. Nitrogen. (9 marks)

3. What are monosaccharides? Give three tests by which hexoses can be identified. How would you distinguish an aldo-hexose from a ketohexose? (9 marks)

4. How is glycol prepared in the laboratory? Give its important properties and uses. How would you prove that Glycol has the formula cH_2 OH. cH_2 OH and not cH_3 cH $(OH)_2$. (12 marks)

5. How would you prepare Benzene from acetylene? By what reactions is Benzene distinguished from the hydrocarbons of the fatty series? (12 marks)

6. Describe two methods by which chlorobenzene can be prepared. In what way does it differ from its aliphatic analogues? (9 marks)

7. Starting from Benzene how would you prepare Benzoic acid? Enumerate its chief physical and chemical properties and uses. (9 marks)

8. How is Anthracene prepared on a commercial scale? Mention its important properties, reactions and uses. (9 marks)

Three hours.] **ZOOLOGY** [60 marks.

Answer six *questions only.* Questions 3 and 5 are compulsory.

1. Mention the chief characteristic features of animals and plants. Discuss their inter-relationships. (9 marks.)

2. Briefly describe with sketches the structure and life-history of the liverfluke. (9 marks.)

3. What are the chief functions of blood? Compare the main features in the circulatory system of earthworm, cockroach and frog (12 marks)

4. Describe the feeding habits of the following animals:—
(*a*) malarial parasite, (*b*) leech, (*c*) praying mantis, (*d*) snake, (*e*) eagle, and (*f*) elephant. What structural adaptations do they show? (9 marks)

5. 'Though insects and man stand far apart in their status, there exist numerous intimate relations between them.' Explain. (12 marks)

6. Describe the developmental stages in a frog and a butterfly. What biological peculiarities do you notice? (9 marks)

7. What are the main distinctive features of 'Fishes'? Classify 'Fishes' and state how they are economically important. (9 marks)

8. Explain the following with suitable illustrations:—
(*a*) Struggle for existence, (*b*) Reduction division, (*c*) Alternation of generations, (*d*) Metameric segmentation, (*e*) Asexual reproduction, and (*f*) Protective colouration. (9 marks)

SECOND EXAMINATION

AGRICULTURE: PLANT HUSBANDRY—I

Three hours] [100 Marks.

Answer six *questions only* Questions 1 and 6 are compulsory.

1. What principles should a good farmer observe in manuring his lands? (18 marks)

2. Describe the method of preparing compost from organic waste material and explain the action involved in the process. (16 marks)

3. What is the difference between soil improvement and soil reclamation? (16 marks)

4. 'The fertility of a soil can be improved or maintained by proper rotation, fallowing and raising mixed crops.' Explain. (16 marks)

5. Cropping trials should be done before irrigation works are undertaken in a tract. Why? (16 marks)

6. What advice would you give a farmer who purchases improved strains of paddy seed from the Agricultural Department regarding the preparation of nursery and maintenance of purity of seed? (18 marks)

7. Give the normal acre yield of paddy in your district in the local measure and compare it with the yield obtained in the Central Farm. How many Madras measures of rice can be got from a Salagai of paddy and what will be the weight of rice in pounds? (16 marks)

8. What are plantation crops? Describe in detail the preparation of the marketable produce in the case of any two of them. (16 marks)

3 hours] AGRICULTURE: PLANT HUSBANDRY—II [100 marks.

Answer six questions only. Questions 1 and 4 are compulsory.

1. What is the difference between Productive Irrigation Works and Protective Irrigation works? Under what class does the proposed Tungabhadra Project come? Give reasons. How will this project help in the intensification of existing cultivation? (18 marks)

2. What is Sewage? How does it differ from sullage and effluent? Describe the various methods by which Municipal rubbish and night soil could be converted into Poudrette. (16 marks)

3. What are the causes of Soil Erosion on the Nilgiris? Enumerate all the methods that could be adopted to control and prevent the same. (16 marks)

4. The Cotton Specialist has evolved a new strain of Cambodia cotton which is superior to Co. 2 in every way. Cambodia cotton is grown in Coimbatore District over two lakhs of acres under irrigated conditions. Draw up a detailed scheme to multiply the seed of the improved strain of cotton so that it replaces Co. 2 completely in five years. (18 marks)

5. Cambodia cotton, cholam, ragi and tobacco are grown under a well in the course of two years. State what rotation will be followed and describe briefly the time of sowing, duration, time of harvest, yield, quantity and time of application of manures, if any, for the crops. (16 marks)

6. Under what conditions and in what parts of the Presidency do you find (*a*) Artesian wells, (*b*) Spring wells, and (*c*) Percolation wells? How is the water table affected in each of the three class of wells in different seasons? What are the crops that could be grown in summer season under each class of well with the mininum expense on irrigation? (16 marks)

7. Describe briefly how you would lay out a 10 acre plot of red loamy soil to raise Oranges, Mangoes, Sapotas, and Guavas. How many plants of each kind of fruit tree would you plant and what should be the spacing? Would you plant seedlings, or grafts, or budded plants? Give reasons for your choice and state when the plants would come to full bearing and give maximum yield. (16 marks)

8. What are the improvements effected in the Dry Farming Station, Hagari, for the benefit of the ryots of Bellary District with regard to (*a*) crops, (*b*) methods of conserving soil moisture, and (*c*) prevention of soil erosion? (16marks)

3 hours.] AGRICULTURAL ENGINEERING [60 marks.

Answer six questions only. Questions 1 and 5 are compulsory.

1. *a*) A well grown crop of cholam is standing on a field in the shape of a quadrilateral. You are asked to find out its acreage by surveying it with only a chain. Describe both field and office work involved.

b) Find out the area correct to a cent of a field bounded by the three straight lines AB, BC and CA given the following data:—

AB measures 610 links and bears 61° and the observed bearings of BC and CA are 300° and 201° respectively. (12 marks)

2. A contractor has agreed to do at Rs. 12 per unit earthwork in excavation for a well. The bottom measurements are 30 feet long and 20 feet broad. The depth is 20 feet and the side slopes are 1:1. He submits his bill by the mean measurements. Calculate the difference between this and the correct charge. (9 marks)

3. Three units of concrete broken stone in cement mortar in the proportion of 1:3:6 are to be laid for the 3 feet deep foundation of a stationary engine. Work out the quantities of the several materials required and describe the operations involved. Detail the tests which the cement should have been subjected to, before being passed for the work. (9 marks.)

4. A tank has a catchment area of 4 square miles. If the maximum recorded rainfall is 6 inches in 24 hours and if only 60% of this reaches the tank, what length of surplus weir would you provide allowing a margin of 18 inches between F. T. L. and M. W. L.? (9 marks)

5. a) Explain the terms (i) Hydraulic mean radius, (ii) Resistance Head, (iii) Pump efficiency, and (iv) Engine efficiency.

b) For supplying water to an Agricultural Colony whose requirements are 9,000 gallons per hour, it has to be pumped through 1,500 feet of 4 inch pipe by a centrifugal pump worked by a crude oil engine. If the static head is 70 feet and the efficiency of the pump 60%, calculate the horse power that must be applied to the pump shaft.

If the low water level is 50 feet deep, sketch a suitable location of pump and engine. The depth is measured from the ground surface of the supply well. (12 marks)

6. Discuss, in short notes, with illustrative sketches, how the following sources of power have been pressed into service at the Central Farm and the Agricultural College Estate at Coimbatore:—

Wind, Oil, Steam and Electricity. (9 marks)

7. Discuss factors operating against direct drives in the case of Farm Engines and Machines and indicate solutions. What should be the diameter of a cold rolled steel shaft to transmit 20 horse power through a 3 feet diameter pulley keyed on to it? What size pulley would you fit on the engine shaft whose standard normal speed is 300 R. P. M.? (9 marks)

8. Sketch in outline a modern Threshing machine naming the various parts and indicating their functions and adjustments for dealing with different grains. (9 marks)

3 hours.] AGRICULTURAL ZOOLOGY [60 marks.

Answer six *questions only*. Questions 2 and 7 are compulsory.

1. Describe clearly with the help of diagrams the organs collectively known as 'the mouth parts' in insects, pointing out the different types of this mechanism found among them. Explain how a knowledge of the mouth parts of any insect is helpful to the farmer. (9 marks)

2. Explain what you understand by 'A Crop Pest Calendar'; discuss its uses, if any. Prepare such a calendar for the Coimbatore area in relation to the important pests of that tract. (12 marks)

3. Name the insect or insects associated with the following plant diseases and give a brief account of each of them with the control measures possible against each:—

(*a*) Leaf curl of chillies, (*b*) Honey dew disease in mango. (*c*) *Surul* of groundnut, (*d*) Silver shoots of paddy, (*e*) Sugarcane leaf blight, (*f*) Cotton stem galls. (9 marks)

4. Give two examples of economic insects from each of the following groups, explaining the nature of the economic importance in each case;

Limacodidae, Capsidae, Coccidae, Cerambycidae, Sphingidae, and Thysanoptera. (9 marks)

5. Give a brief account of the important insect pests of stored agricultural products found in South India and state what control measures you would suggest. (9 marks)

6. 'The study of the relations between insects and climate is of very great importance in agriculture.' Discuss this remark with special reference to South India. (9 marks)

7. Write short notes on:—

(*a*) Hairy caterpillars, (*b*) Ericulture, (*c*) Borers, (*d*) Contact insecticides, (*e*) Insect phototropism, (*f*) Entomophagous insects. (12 marks)

8. Write a very brief summary, not exceeding three pages, on what is known as the 'Balance of life nature' with special reference to insects, explaining the important factors influencing this balance. (9 marks)

Three hours.] ANIMAL HYGIENE [60 marks.

Answer six *questions only*. Questions 3 and 5 are compulsory.

1. Enumerate the bones that constitute the cranium in the ox and describe briefly the one that is most extensive among them. (9 marks)

2. Describe the kidney of the ox and compare it with that of the sheep. Give the composition of their urine. (9 marks)

3. Explain with the aid of diagrams how the uterus of an ewe differs from that of a cow. Mention the period of gestation in these two species. What are the signs of oestrum in the cow and how long does it last? (12 marks)

4. State the uses and doses of the following drugs for a bullock:—(*a*) Chiratta, (*b*) Ammonium carbonate, (*c*) turpentine. Make out a prescription for a cough electuary to be given to a calf six months old. (9 marks)

5. Write an account of black-quarter with special reference to its etiology, mode of infection, symptoms and immunology. Give its differential diagnosis. (12 marks)

6. Name the common diseased conditions met with in the udder of the cow. Narrate briefly the cause, treatment and prognosis of any two of them. (9 marks)

7. Write short notes on the symptoms, treatment and prophylaxis of the following ;—
(*a*) ringworm, (*b*) liver-rot, (*c*) fowl cholera. (9 marks)

8. Discuss the general principles of feeding and nursing of sick animals. (9 marks)

FINAL EXAMINATION

AGRICULTURE—ECONOMICS AND FARM MANAGEMENT

Three hours] [100 marks.

Answer six *questions only.* Questions 2 and 8 are compulsory.

1. Write short notes on:—(*a*) Mixture crops, (*b*) Mixed cropping, and (*c*) Mixed farming. Mention the advantages and conditions necessary for their success. (16 marks)

2. After finishing your agricultural training you are provided with a capital of Rs. 25,000 and asked to live by farming. Where would you locate your farm, what kind of farming would you undertake and how would the capital be utilised for the purpose ? (18 marks)

3. Prepare farm accounts for the cultivation of the following crops, each grown on an acre:—(*a*) Wetland Paddy, and (*b*) Garden land Cambodia Cotton. (16 marks)

4. At the Pollachi market groundnut kernel sells at Rs. 25 per candy of 500 lb., jaggery at Rs. 10 per pothi of 250 lb., Cambodia cotton lint at Rs. 250 per candy of 750 lb. Taking into consideration normal yields and costs of cultivation of these crops in the Coimbatore district, work out profit and loss statements. (16 marks)

5. Discuss the different factors on which the value of agricultural land depends. (16 marks)

6. In recent years, the area under groundnut in the Madras Presidency is on the increase and the area under food crops is on the decrease. The population of the presidency is on the increase. Do you approve such a state of crop production ? How is the shortage in food grains to be met for the growing population ? (16 marks)

7. The pressure of population on land in certain districts is more than on others in this Presidency. What will be the effect of thick population on (*a*) the agriculture of the district, (*b*) the labour available in the district, and (*c*) the price of land ? (16 marks)

8. Write a short note on the laying out of plots for field experiments. (18 marks)

3 hours] AGRICULTURE—ANIMAL HUSBANDRY [100 marks.

Answer six *questions only.* Questions 1 and 4 are compulsory.

1. A ryot purchases a Kangayam Bull Calf, one and a half years old, from a leading stock-breeder, for using it as a stud bull. He proposes to recover the cost of maintenance of the bull within five years by levy of service fees. Estimate in detail the cost of maintenance and the service fees which he would be able to realise in order to recover his expenses in five years. (18 marks)

2. (*a*) How would you allocate the marks in a score card for a good Dairy cow ?

(*b*) Which breed of cow would you recommend to a ryot who wishes to start a Dairy on a large scale ? Give reasons for your choice. (16 marks)

3. Dearth of fodder in summer season is a problem in Coimbatore district. Suggest ways and means of solving it with reference to (*a*) local farming practices, (*b*) forestry, and (*c*) livestock. (16 marks)

4. The Perundurai Sanatorium requires 2,000 lb. of hygienic milk and 150 lb. of butter per day. A Producers' Milk Supply Union undertakes to supply pasteurised milk and butter, salted and untouched by hand. Describe in detail the equipment required in the Dairy Room and assess the capital outlay involved. (18 marks)

5. (*a*) Describe in detail the points you would look for in selecting a fast moving draught bullock.

(*b*) What breed of animal would you select for heavy draught work in the Ceded Districts ? Give reasons. (16 marks)

6. Which is the economic dual purpose breed of fowls you would recommend for Poultry farming ? Work out the economics of maintaining for one year 50 hens and the requisite number of cocks. (16 marks)

7. It is proposed to grade up the local sheep near Podanur, so that they could get uniform and better quality of wool for the local carpet industry and good mutton for Podanur and Coimbatore markets. What breed of stud Ram would you introduce in order to achieve their object ? What is the procedure you will adopt and how long will it take for complete success ? (16 marks)

8. Write short notes on ,—

(*a*) Nicking, (*b*) Atavism, (*c*) Capon, (*d*) Livestock Insurance, (*e*) Automatic Egg grader, (*f*) Escutcheon, (*g*) Kikyu grass, (*h*) Wyandotte. (16 marks)

Three hours.] AGRICULTURAL BOTANY—I [100 marks.

Answer six questions only. Questions 1 and 7 are compulsory.

Diagrams and illustrations should be given wherever necessary.

1. Enumerate the oil yielding crops raised in Madras Province mentioning their botanical names, families, varieties, distribution in the Province, economic importance, morphology of the oil-yielding portion and the usual methods of extraction. (18 marks)

2. What is 'seed testing'? Discuss its importance as a practice in scientific agriculture. Given samples of paddy, cotton and groundnuts, explain the nature of the tests you would conduct in assessing the samples. (16 marks)

3 Classify the cottons grown in South India and describe the morphological characters by which you would distinguish the species and varieties. (16 marks)

4. Mention examples of two indigenous and two introduced forage grasses which flourish in this Province. Describe their methods of propagation. Give a botanical description of any one of them. (16 marks)

5. Give a complete botanical description of the banana plant. Give a brief account of its geographical distribution in the world. (16 marks)

6. Describe the procedure you would adopt for the vegetative propagation of the following fruit crops:—

(*a*) orange, (*b*) mango, (*c*) apple. (16 marks)

7. Given your requirements in land, labour, manure and irrigation facilities, mention the horticultural operations necessary to successfully raise either (*a*) 50 cents of tomatoes in Coimbatore taluk, or (*b*) 25 cents of grape vines in Nilakkottai taluk (Madura District). (18 marks)

8. Enumerate the vegetable crops raised in Coimbatore taluk. Mention their scientific names, the natural orders to which they belong and draw floral diagrams for one species in each order. (16 marks)

3 hours.] AGRICULTURAL BOTANY—II. [100 marks.

Answer six questions only. Questions 2 and 7 are compulsory.

Illustrate your answers with suitable diagrams.

1. Explain clearly the 'Theory of mutation' and point out its practical bearing on the improvement of crops. (16 marks)

2. How would you utilise the principles of Mendelism in the improvement of the following crops?—

(*a*) Groundnut, (*b*) Cumbu. (18 marks)

3. Give a short account of the 'Reduction division of nucleus and its bearing on 'heredity'. (16 marks)

4. Describe the reproductive processes in ferns and compare them with the reproductive processes in Angiosperms. (16 marks)

5. Give an account of the preparation of a Pure culture of any fungus to incculate a healthy plant. (16 marks)

6. Give a short account of the 'Evolution of Sex' in Fungi. (16 marks)

7. Describe in detail the life-history of 'Ring-disease' of Potato giving the characteristic symptoms and the measures taken to keep the disease under control. (18 marks)

8. Give a short account of the life-history of the Phytophthora causing the 'Bud-rot of Palmyra'. What are the measures adopted to combat this disease? (16 marks)

3 hours.] AGRICULTURAL CHEMISTRY—I [100 marks.

Answer six *questions only*. Questions 1 and 6 are compulsory.

1. What are the distinguishing characteristics of red, laterite, black-cotton, alluvial and peaty soils so far as their physical and chemical constituents are concerned? How do they differ from each other in their water-holding capacity and retention of manures and what are the reasons for such differences? (18 marks)

2. Write short notes on the work of the following in the development of agricultural science:—

Justus von Liebig, Lawes and Gilbert, Hellriegel and Wilfarth, Thompson and Way. (16 marks)

3. Describe one good modern method of conducting mechanical analysis of soils on a mass scale. How would you interpret the results obtained? (16 marks)

4. Describe a suitable chemical method, other than Dyer's, to determine ingredients that would give an idea of the fertility of soils. (16 marks)

5. Explain how the following manures become available to plants when they are added to soils:—

a nitrate, sulphate of ammonia, groundnut cake, superphosphate, bonemeal, and sulphate of potash. (16 marks)

6. Discuss the general functions of nitrogenous, phosphatic, and potash manures when applied to ordinary field crops. Specify any such manures which should not be used for certain crops like tobacco and potato with reasons therefor. (18 marks.)

7. Discuss the merits of cane juice needed for making sugar as well as jaggery, and describe one good method of producing white sugar direct from cane. (16 marks)

8. Discuss the various methods that are being proposed for the disposal of the huge amount of molasses produced in this country at present. Which is, in your opinion, the most feasible and profitable method and why? (16 marks)

3 hours] AGRICULTURAL CHEMISTRY—II [100 marks.

Answer six questions only. Questions 1 and 5 are compulsory.

1. (*a*) What are the two main groups of feeding stuffs? State how each group is of importance in the nutrition of cattle. What are the commonly available feeding stuffs of each group in this Presidency?

(*b*) Two samples of groundnut cake *A* and *B* are available on the market, their composition is given in the table below. Sample *A* sells at Rs. 35 per ton. Sample *B* at Rs. 31 per ton, which would you choose for your cattle and why?

		Sample A	Sample B
Moisture	...	10·10%	7·30%
Protein	...	42·90%	50·30%
Fat	...	6·60%	8·60%
Fibre	...	10·70%	8·60%
Carbohydrate	...	29·70%	25·20%
Acid value	...	21·0	171·0

(8 marks)

2. Why is a sliding scale of rations fed to milch cows in the College Dairy? State approximately the standards for cows of different grades. What is the principle underlying the adoption of the sliding scale? (16 marks)

3. Describe with experimental details how the Ether Extract of a feeding stuff is estimated. What is the significance of the Ether Extract in animal nutrition? (16 marks)

4. Write short notes on:—

(*a*) Pastures in relation to cattle disease, (*b*) Starch equivalent. (*c*) Effect of manuring on crop quality, (*d*) Plants as a source of vitamins, (*e*) Uptake of mineral matter by plants, and (*f*) Respiratory quotient. (16 marks)

5. What do you understand by the fixation of atmospheric nitrogen by leguminous plants? Give a brief description of the process and its importance in agricultural economy. (18 marks)

6. State briefly what you know about the carbohydrate metabolism of plants. Name two crops in which the final product of metabolism is of world-wide economic importance. (16 marks)

7. What is the average composition of cow's milk? How best should it be processed for marketing at some distance from the source of supply? What are the factors that make for spoilage in milk? (16 marks)

8. Why is milk considered to be an ideal food? How is its value affected by external conditions to reduce its quality as an ideal food? How would you prevent such a reduction in quality? (16 marks)

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EDITORIAL

The development of scietinfic agriculture in India has made phenomenal progress since the days when Agriculture was one of the many subjects administered by the Land Revenue Department. The inauguration of separate departments of Agriculture and the consequent separation of the functions of the Revenue and Agricultural Departments was the inevitable outcome of a well-conceived policy of the Government of India and the provincial governments to improve the agricultural conditions of the country. The paramount need for special study and research into specific agricultural problems necessitated the establishment of a net-work of agricultural research stations and the employment of a specially trained staff for manning them. The collection of knowledge from experiment and research is however, only the first phase of the battle. The dissemination of the knowledge to the cultivators and the fight against ignorance, prejudice and superstition constitute a protracted struggle. The willing co-operation of sister departments in this endeavour is an asset of inestimable value. With its ramifications even through the remotest villages, with its unique opportunities of contact with the cultivating classes and with the influence it commands on the life of the rural folk, the Land Revenue Department has remained a potent force for the spread of the agricultural gospel. With the expansion of the functions of the Agricultural department and its ever-increasing contributions to the advancement of scientific agriculture, the desire has often been expressed for a greater co-ordination of the work of the two departments of Government directly concerned with the basic industry of the land. The problem of effecting such co-ordination has apparently been the serious concern of the Government of Madras for some time past. We are glad that a Government Order, the text of which we publish elsewhere in this issue, makes the Collector and the District Agricultural Officer jointly responsible for the agricultural programme of each district and formulates several ways and means to ensure greater contact and co-operative effort between the officers of the two departments. One remarkable feature of this new scheme is that the ways and means suggested have emanated from a conference of District Collectors. It is a happy augury that the most influential section of public officials has shown a new orientation in its outlook and has committed itself to its willing co-operation.

Yet another proof of Government's desire to work this ideal is found in a recent amendment to the *Indian Civil Service Manual*, making provision for a period of training for Assistant Collectors at the nearest Agricultural Research Station and for another period of tour with the Agricultural Officer of the District, so that they may 'acquire a knowledge of crops, seasons, and agricultural practices of the Province' The Government of Madras are to be congratulated on being the first in the field to translate their convictions into action. If Madras succeeds in its endeavour, her success will be an object lesson to other Provinces and States in India. To ensure success, it will be the duty of both Departments to implement Government's desire faithfully and in the true spirit of co-operation. Decadent ideas of prestige, should vanish and all opportunities availed to lend a helping hand. We feel confident that when this is done, the hope recently expressed by His Excellency the Governor of Madras 'that the results of various researches will be put across to the ryots in a more effective manner and that the help of the Department to the ryot will take a far more practical shape' will not be long in fulfilment.

A Refresher Course for Agricultural Demonstrators. The proposals made by the Director of Agriculture to institute a refresher course lasting for a month at the Agricultural College and Research Institute, Coimbatore for the benefit of Senior Agricultural Demonstrators have received the acceptance of the Madras Government. The wisdom of this measure is undisputed. There has occurred several developments in the Agricultural sciences and new subjects of instruction have been added to the curriculum of studies since the earlier batches of Agricultural graduates left their College. Those engaged in district work have seldom had opportunities to go back to their *alma mater* and if they did, they did not have the time or the opportunities to acquaint themselves with the more recent developments in agricultural research. Despite accumulated experience gained in specific lines of work carried out in their own jurisdictions, these officers have been labouring under a handicap. The course of instruction provided in the refresher course which is at once comprehensive and almost wholly practical, seeks to remedy the handicap and to equip the district worker with better ideas and more practical knowledge in the improvements he has to urge on his clients. We welcome this measure as one calculated to strengthen the propaganda wing of the Department.

Banana Figs and Banana Flour with special reference to Madras Varieties.

By K. CHERIAN JACOB, L. Ag., F. L. S.,

Agricultural Research Institute, Coimbatore.

Banana Figs. Ripe bananas when dried are known as banana 'figs'. They are prepared in the following manner :—

Ripe fruits are peeled, split longitudinally into two halves and each half again cut across into three or more pieces about an inch in length according to the size of the fruit, with a stainless knife or a sharp blade made of bamboo. The cut pieces are dried by exposing them to hot sun in wooden or bamboo trays with mosquito net coverings to keep off flies, or wooden trays with glass tops provided with ventilators for free passage of air. If suitable coverings are not used, maggots appear in the figs as the result of eggs laid by the flies on them while exposed for drying. The figs have to be dried for four or five days in a place free from dust when they will be ready for use. These may be packed in butter paper and stored in closed containers. They keep well for three to four months.

Under-sized banana bunches, which may not fetch good prices, normal bunches when there is a glut in the banana market due to over-production and those grown in out-of-the-way places with limited transport facilities, may with advantage be utilized in the preparation of these figs.

Varieties, the fruits of which are rather juicy, are generally preferred for making banana figs. The best Madras varieties suitable for this purpose are *Chakkarakeli, Nendrans, Pey kunnan, Poovan, Suganthi, Kostha bontha, Vamanakeli, Peyan. etc.* *Chakkarakeli* being a very costly fruit is too good for this purpose even though it makes the best figs. *Nendrans* also make very good figs but are available only in the West Coast where there is a ready market for them and may not be profitable for this industry. Figs prepared of the varieties *Vamanakeli, Peyon* and *Sirumalai* manifest a deliquescent tendency besides being also too costly for this purpose.

The varieties, that are used for banana fig making, should, in addition to their juicy nature, also be heavy yielding and be easily grown anywhere even under adverse conditions. The varieties answering all the conditions are only very few. The best Madras varieties are *Pey kunnan, Kostha bontha, Poovan* and *Suganthi.* All these varieties can be easily grown under diverse soil and climatic conditions. *Pey kunnan* and *Kostha bontha* thrive even in alkaline soils though bananas in general are very susceptible to alkalinity.

Banana fig making by drying in the sun may be done during summer months or whenever there is a fairly long break in the monsoon. It should not be tried during the monsoon season when the unfinished products get mouldy and become unsuitable for the purpose.

A dehydrator for preparing banana figs quickly was tried at the Agricultural Research Station, Samalkot, Godavari District, during 1937—38 and compared with the sun-drying process. The figs of *Chakkarakeli* were ready in about 10 hours by the dehydrator at 54°C—65°C, while it took 5—6 days at 40°C - 45°C by the sun-drying process. Though the finished product was obtained much quicker in the dehydrator the quality was found poor and the cost of production high.

Only well ripe banana fruits should be used for making figs; otherwise, the figs will be hard and less sweet even though the quantity obtained will be slightly high due to some starch left in the under-ripe fruits. In the variety *Pey kunnan* under-ripe fruits gave 28%, ripe fruits 24% and well ripe fruits 21·5% of figs. The last one was very soft, sweet and of the colour of honey.

The percentages of banana figs to fruits at different stages in the varieties *Chakkarakeli* and *Pey kunnan* are given below:—

	Percentage. *Chakkarakeli*	*Pey kunnan*
The rachis (6″ of peduncle, axis and 3″ of axis of inflorescence above fruits) to unripe fruits in bunch soon after harvest.	11.3	6 7
Ripe fruits in hands to unripe fruits in hands ...	88·3	88·1
Pulp to ripe fruits in hands	65·9	76·2
Banana figs to pulp	27·6	30·25
Banana figs to bunch (with 6″ of peduncle, central axis and 3″ of axis of inflorescence above unripe fruits) soon after harvest	12·6	17·7
Banana figs to unripe fruits in hands	15·8	19·0
Banana figs to ripe fruits in hands	18·2	21·5

It will be seen from the above that *Pey kunnan* yields a higher percentage of figs than *Chakkarakeli.*

Banana fig is a highly concentrated food suitable for travellers. Weight for weight banana figs are more nourishing than wheat bread. A pint of milk and six ounces of banana figs make a good meal (Fawcett). In places where fresh bananas could not be easily and economically obtained, banana figs can very well take their place. If the banana figs are sufficiently advertised and popularized in parts of Northern India where bananas are not grown or easily obtained, a good market can be found for banana figs produced in South India.

Standardized bunches of 8 or more hands and occasionally of 7 are exported to America and Europe from the West Indies. The undersized bunches fetch only one-fourth the normal price and are therefore not exported. These bunches are therefore converted into banana figs with profit. There are several factories at work in Jamaica for banana fig manufacture. The figs used to be exported to European countries at 42 shillings per hundredweight. Banana figs were used as part of army rations in Austria; and for all purposes where it was of consequence to have food in small compass (Fawcett).

Analyses of the banana figs of varieties *Chakkarakeli* and *Pey kunnan*.*

		Chakkarakeli.	*Pey kunnan.*
Moisture	...	10·85	8·20
Ash	...	3·48	2·88
Proteins	...	5·48	2·91
Sugars { Reducing	...	43·29	53·68
Sugars { Non-reducing	...	10·66	1·05
Fat, fibre, etc.	...	26·24	31·28
		100·00	100·00
Lime (CaO)	...	·116	·123
Magnesia (MgO)	...	·11	·194
Potash (K_2O)	...	·195	·141
Phosphoric acid (P_2O_5)	...	·306	·202
Nitrogen	...	·82	·47

Banana flour. Banana flour is made from fully mature unripe bananas, i. e., before the starch is converted into sugar by ripening. Unripe fruits are peeled, cut into thin slices and sun-dried. It is difficult to peel green bananas, but with some experience it can be easily done. If the green bananas are thrown into scalding water (176°F) for four or five minutes the peel is easily removed. Ordinary steel knives should not be used as they turn the cut surfaces of bananas black; nickel blades or stainless knives should be used. These slices are dried in the sun for about four days when the percentage of water contained in them will be reduced from 70 to 15. These chips are then milled in flour mills and sifted. There are factories in the West Indies with vacuum apparatus for the manufacture of banana flour. The flour is packed in boxes or barrels lined with paper. It is also exported to England as banana chips as milling, sifting, etc., are better done there.

The percentage of banana flour to unripe fruits varies slightly with different varieties. The percentage of flour to unripe fruits in hands in the variety *Poovan* is 1·75 and in *Adakka kunnan* 21·2. The percentage of flour to unripe fruits in bunches in *Poovan* is 15·2 and in *Adakka kunnan* 18·3.

Statement showing the analyses of banana flours of five Madras varieties as compared with those of rice and wheat:*

	Poovan	*Pay ladan*	*Kunnan*	*Then-kunnan*	*Adakka kunnan*	*Rice*	*Wheat*
Moisture	10·9	10·3	10·5	10·8	10·2	11·6	12·3
Ash	2·5	2·2	2·5	2·0	3·0	1·2	0·6
Crude proteins	2·8	2·8	2·9	2·9	4·9	6·6	10·2
Ether extractives	0·8	0·5	0·6	0·4	0·9	0 1	1·3
Crude fibre	0·8	0·9	1·3	0·7	1·4	0.1	0·3
Carbo-hydrates	82·2	83·3	82·2	83·2	79·6	80·4	75·3
Total	100·00	100·00	100 00	100·00	100·00	100·0	100·00

* The analyses were done by the Government Agricultural Chemist, Coimbatore.

Banana flour is also known as banana meal. It is rich in carbohydrates and mineral matter, but poor in protein. The starch of banana is more easily digestible than cereal starches.

The British Medical Association recommends the use of banana flour in infant feeding. It is cheap and wholesome, possessing a high nutritive value. It can be made in a few minutes by mixing up a heaped table spoonful (one ounce) of banana flour with a pint of water and then boiling for five minutes. A gruel made in this way has excellent colloidal properties when added to milk in equal quantity; it thickens the milk and prevents formation of a leathery coagulum of casein and satisfies the appetite of hungry infants more effectually than simple milk dilutions. Banana gruel is particularly suited for patients recovering from typhoid fever and is excellent in cases of dysentery and similar abdominal complaints. In cases of chronic dyspepsia and gastritis properly prepared banana flour is easily digested.

Banana flour is a common infant food in the West Coast of the Madras Presidency (Malabar, Cochin and Travancore). The flour of the varieties *Adakka kunnan* and *Nendran* is used for this purpose Non-juicy varieties are generally preferred. The flour of *Kunnan* series (*Adakka kunnan, Kunnan, Venneettin kunnan, Then kunnan* and *Thattilla kunnan*) is considered superior to that of other varieties. The flour of *Nendran* has a high percentage of calcium and phosphoric acid. The food stuffs and fodders of the West Coast are generally deficient in these two minerals; but nature has so adjusted the requirements of people by making this variety of banana an important article of food in this coastal region, while it is not much liked by people in other parts of the Presidency. The *Adakka kunnan* contains double the quantity of protein that is usually found in any other variety of banana and it is a happy coincidence that the flour of this variety has for long been in use in Malabar as an important infant food.

Bread and biscuits are made of banana flour in foreign countries with the addition of wheat flour. The banana bread is uniform in texture, permanently moist, of a golden colour, and very nutritious. Banana flour is particularly suitable for the manufacture of yeast used in breweries (Arguelles).

There is ample scope for the development of banana fig and banana flour making, as cottage industries in many parts of this Presidency where conditions favourable for their manufacture prevail.

The following are the various local names for some of the important varieties suitable for banana fig and flour making.

Chakkarakeli (Musa paradisica Linn., var., *Chakkarakeli).*

Shahaja in Isikki lands near Vizagapatam, *Saja aratti* in Simhachalam, *Tella chakkarakeli* in Tanuku, *Manch chakkarakeli* in Vellattur in Repalle taluq of the Guntur district, *Pedda chakkarakeli* in Siruvalanka, *Rajakili* in Pudupatnam near Sadras, *Kari uazhai* in Trichinopoly, *Mysore Rasthali* in Mettupalayam, *Then*

kadali in Erode, *Rasthali* in Srivilliputtur, *Chakkara kadali* in Trichur, *Aa bale* in Virarajendrapet, *Raja vazhai* in Kulittali.

Largely grown in Godavari district.

Poovan (*Musa paradisiaca* Linn., var. *poovan*).

Vasana chettu in Gopalpur, *Ginni*, *Karpura chakkurakeli* in Piridi near Bobbili, *Chakkarakeli* in Velpur near Tanuku, *Karpura* in Peravalli near Tanuku, *Rasthali* in Challapalle, *Soan mowze* in Kurnool town, *Sugantham* in Kalava near Kurnool, *Yerra sugantham* in Giddalore, *Sugandhi* in Rampuram near Tungabhadra, *Rasa balai*, *Salem* in Hospet. *Bengala* in Allipuram near Nellore, *Yerra aratti* in Godugumuru near Chittoor, *Navarai* in Madurantakam, *Poo vazhai* in Modikuppam near Chittoor, *Raja vazhai* in Gudiyattam. *Dora vazhai* in Kallar Government Gardens, *Kallath vazhai* in Mettupalayam, *Erode poovan* in Coimbatore, *Puluppu kai*, *Korangu vazhai* in Pollachi, *Mysore poovan* in Gudalur, *Adukku namarai* in Pannakkadu, Pulneys, *Kadali* in Thangachimadam, *Puliohan kadali* in Thisayanvilai, *Cheru kai* in Alwaye, *Palayankodan* in Trichur, *Mysore kadali* in Ponnampet, *Mysore bale*, *Mysore kadali* in Moodbidri, *Mysori* in Kumaranallore, *Mysore* in Mangalore, and *Cheena bale* in Bangalore, *Kari gaddi* in Channapatna, *Rari rasa bale* in Kyatsandra, *Kari bale* in Palhalli, *Othu rasa bale* in Nagavalli, *Kari puttu bale* in Jayacharmarajapura, *Vilayithi bale* in Kowsika, *Huli bale* and *Nanjangud bale* in Ambuga, in the Mysore State.

It is grown throughout the Presidency.

Pey kunnan (*Musa paradisiaca* Linn., var. *pey kunnan* K. C. Jacob).

Sambrani in Yercaud, Shevaroys, Awak legor in Trichur.

Largely grown at Yercaud in the Shevaroy hills.

Nendran (*Musa paradisiaca* Lin., var. *nendran*).

Ettakka in Alwaye, *Chengazeikodan* in Trichur, *Nendra bale* in Virarajendrapet, Coorg, *Thiruvonan*, *Thiruvonan* in Tellicherry.

Largely grown throughout the West Coast.

Adakka kunnan (*Musa paradisiaca* Linn., var. *adakka kunnan*).

Cheru kunnan in Trichur, *Pakada kunnan*, *Chara kunnan* in Kongad near Palghat, *Venneettu kunnan*, *Mutti kunnan* in Perintalmanna, *De kunnan* in Manjeri, *Mundi kunnan*, *Venneer kunnan* in Pulamanthol near Pattambi.

Largely grown in the Malabar District.

Kunnan. (*Musa paradisiaca* Linn., var. *kunnan*).

Madras aratti in Piridi near Bobbili, *Chakkarakeli* in Isikki lands near Vizagapatam, *Ginni* in Chatikona summit, *Neechu* in Khandavalli near Tanuku, *Karpura chakkarakeli* in Velattur near Bhattiprolu, *Amritapani* in Siruvalanka, *Sanna akkulu chettu* in Nidubrolu, *Chinna sugandham* in Giddalore, *Chitti balai* in Kampli near Hospet, *Sugantha* in Musanur near Kavali, *Vellai kadali* in Sankarankoil, *Nar kadali* in Sendamaram, *Kannan* in Alwaye, *Valiya kunnan* in Trichur, *Jirike bale* in Kallamandkur near Moodbidri, *Tirunolli kadali* in Kasargod, *Adukku poovan* in Nileshwar, *Adukkvan* in Kurumathur near Taliparamba, *Nadan kunnanl* in Perintalmanna, *Adukkan* in Tellicherry.

Largely grown throughout the West Cost.

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Distribution of Paddy Varieties in Palghat Taluk.

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General. The wide-spread use of a host of varieties is a striking feature of paddy cultivation in the Malabar district. The practice has probably been found necessary because of the absence of regular irrigation systems, the peculiar distribution of rainfall and the uneven contour of the land. As regards the requirements of the soil and the limitations of water supply every ryot seems to know his lands so intimately that the different varieties are perhaps chosen only to reduce the local irregularities of soil and water supply. The multiplicity of varieties may therefore be taken as an index of the diverse conditions of paddy cultivation prevalent in the locality. Besides this, the type of land and land tenure, resistance to pests and diseases, season and rainfall, the demands of the markets and the mills, also exert a powerful influence on the choice of varieties that are grown. In 1938—39 Palghat taluk raised 207,445 acres of paddy, which represents 71·2 per cent of the annual cultivated area. Farming in the taluk is practically confined to the cultivation of rice in wet lands.

Season and rainfall. There are two regular harvesting seasons for the paddy crop, the first falling about the month of *Kanni* (September-October) and the second about *Makaram* (January-February) and the two are therefore distinguished as the *Kanni* crop and the *Makaram* crop respectively. The *Kanni* crop is sown broadcast in April, while the *Makaram* crop is invariably transplanted from nurseries, separately raised in the month of July. The entire crop is rainfed. The average annual rainfall of the tract is 90 inches of which about 65 inches are received during the South-West monsoon, while the North-East monsoon brings in about 15 inches and the dry, hot weather about 10 inches of rain.

Types of wet land. The wet lands of Palghat, where paddy is regularly grown as a rainfed crop, fall under two distinct types. There are the 'double-crop' lands which raise two successive crops of paddy annually; there are also what are locally known as *pottas* or 'single-crop' lands, which grow only one crop in the year. Of 207,445 acres under paddy (1938—39), the single crop lands constitute 33,981 acres, the remainder being composed of double crop area in its two fairly equal harvesting seasons. The single crop lands form nearly a third of the double crop area in the *Kanni* crop season. Sometimes even a third crop of paddy is raised in summer in the double crop lands which have the benefit of springs or other irrigation sources. But such favoured areas are very rare and their cultivation is of little importance.

Cultivation. In December—January, there is sufficient moisture in the fields after the harvest of the paddy crop. This moisture is taken advantage of to plough the land. Subsequently, cross ploughing, breaking clods and getting the soil into fine tilth, collecting weeds and stubbles for burning on the land are all attended to by way of preparatory cultivation during the hot weather months. On receipt of the first pre-monsoon rains in April, the crop is generally sown broadcast in the dry field, though portions of the single crop lands are also transplanted during the south west monsoon in June-July. The varieties sown in the double crop area are of a comparatively shorter duration than those sown in the single crop lands. The crop is off the double crop lands by the end of August or early in September and is immediately followed by a second crop. In the single crop area, the harvest may get prolonged to October partly due to the late planting and partly because of the cultivation of long duration varieties.

The varieties cultivated in the second crop season are comparatively longer in duration than in the first crop and are therefore sown in separate nurseries in July-August. The success of the second crop depends as much on the quickness with which it is planted before the North-East monsoon rains as on the distribution of the rains in the North-East monsoon itself. The second crop is harvested by December or January and the land is again prepared for the same crop in the succeeding year.

Varieties. The important varieties for the *Kanni* crop are *Chambaan Chornali, Thavalokkannan Kazhama, Areeri* etc., while *Chitteni* and *Anakkomban* are the main types in vogue for the *Makaram* crop. They vary in duration from 3½ months to 5 months in the case of the Kanni crop and 5 to 7 months for the *Makaram* crop. The superior strains evolved by the Agricultural Department are popular for the *Makaram* crop season and the strains in use were reported to be GEB. 24, Co. 1, Co. 2, Co. 3, Co. 5, Co. 8, Adt. 5 and Adt. 8. Their distribution in the six Revenue *Firkas* of the taluk, as revealed by the enquiries made in 1939-40, is shown by the plus sign (+) in Table 1 below.

TABLE I

Distribution of paddy varieties in Palghat Taluk (1939—1940).

Local name of variety.	Revenue Firkas. Palghat Town.	Elapulli	Kollengode	Alathur.	Coyalmannam.	Parli.
Kanni Crop (April—September)						
CHAMBAAN	+	+	+	+		+
Matta-chambaan		+	+		+	
Anna-chambaan		+		+		
Chinna-chambaan					+	
Irippapoo-chambaan		+	+			+
Poo-chambaan			+	+	+	

Local name of variety.	Revenue Firkas. Palghat Town.	Elapulli.	Kollengode	Alathur.	Coyal-manna.	Parli.
CHORNALI	+	+	+	+	+	+
Kata-chornali		+				
Valiya-chornali		+				
Kottayi-chornali						+
THAVALAKKANNAN	+		+	+	+	+
KAZHAMA			+	+		
Chen-kazhama	+				+	
Karin-kazhama		+				+
Veluthari-kazhama			+	+	+	+
Raja-kazhama						+
AREERI	+					+
CHEERA		+	+	+	+	+
KARUPPALI					+	
ARYAN	+					
Pon-aryan				+		+
CHOTTURAYAN					+	
ERJMAKKARI					+	
PARAMBUVATTAN				+		+
NAVARA		+				
Makaram Crop (July—January)						
CHITTENI		+	+	+	+	+
Balan-chitteni	+					
ANAIKOMBAN	+		+			+
VRICHIKAPANDI	+	+		+		
ORUMANIYAN					+	
PAPPARUMANIYAN		+		+	+	
MUNDONPALA				+		+
Karuthamundonpala						+
Chokanna-mundonpala						+
KARANI					+	
VELLARI						+
VELLETHAN					+	+
VELLAKOLI					+	+
VELLARYAN					+	
ARIKKIRARI						+
VALIAVEMBALA						+
KUMBALONE						+
GEB. 24	+	+	+	+	+	+
Co. 1		+				
Co. 2	+	+		+	+	
Co. 3			+	+		+
Co. 5	+			+		
Co. 8	+	+	+			
Adt. 5		+	+			
Adt. 8		+	+			

As there are many varieties under cultivation in every holding, the mixing up of types is inevitable and it is indeed a problem to select seeds free from mixtures with other varieties. The economic disadvantages of sowing mixed seeds are realised, though imperfectly, by many ryots but rigorous avoidance of mixtures is seldom practiced. However, in an otherwise undiversified farming, where paddy follows paddy in necessary repetition, the innumerable local varieties are in a way pleasing as well as useful from the occupational standpoint.

Spread of strains. Out of 26 holdings examined at random in the Palghat taluk, ten were found using small quantities of improved strains of the Department. The strains found popular were GEB. 24, Co. 2, and Co. 3 and they were confined to the *Makaram* crop. The Coimbatore strains have spread in the tract since they fit in well between the local *Chitteni* and *Anakkomban*. From planting to harvest they take about 90 days for GEB. 24, 110 days for Co. 2 and 115 days for Co. 3 while *Chitteni* and *Anakkomban* take 100 and 130 days respectively. *Chitteni* is grown in fairly highlevel fields whereas *Anakkomban* is raised in much lower situations with assured water supply. Between these two, many gradations could be noticed in the nature of the fields, where such small intervals as 5 to 10 days or even less in the duration of varieties are specially helpful to tide over conditions of drought. The Coimbatore strains, that have spread, fulfil this purpose and hence their popularity. Moreover, they fetch a better price in the market because of their superior quality. It is a disconcerting feature, however, that many ryots are tempted by the high prices offered for improved varieties and sell away their entire stock, even their seed material, and thus hinder the normal spread of strains. There is certainly scope for a more widespread use of strains and it will be obvious from the accompanying table that even each holding could increase its area under superior types.

TABLE II. Distribution of improved strains in 10 holdings in Palghat taluk (1939--40)

Cropping Season.	Total quantity* of seeds used in each holding.	Names of strains used.	Quantity* of strains used.	Percentage of strains to total seeds used.
July—August	25	GEB. 24	10	40·0
to	35	GEB. 24	4	11·4
	40	GEB. 24	9	22·5
December—January.	70	Co. 3	11	15·7
	78	GEB. 24	8	10·3
		Co. 2	25	32·1
(*Makaram*)	80	Co. 2	15	18·8
	100	Co. 3	25	25·0
	110	GEB. 24	60	54·5
	120	GEB. 24	10	8·3
	144	GEB. 24	10	7·0
Average,	80·0		19·0	23·0

(* Quantities are expressed in *para*, a local measure, weighing 16 to 18 lb. of dry paddy)

As regards the *Kanni* crop, selections from the Agricultural Research Station at Pattambi in South Malabar have yet to gain a foot-hold. Their popularity in the tract is ultimately a matter of their ability to imitate the growth intervals of the local types. The main varieties and their many sub-types are of relatively short duration and are peculiar to the taluk, which is situated mid-way between the rest of Malabar and the dry regions of the Coimbatore district. Here, isolation and selection from among the local varieties and their spread seem to be the need of the hour.

Acknowledgements. The survey was made under the guidance of Sri. C. R. Srinivasa Ayyangar, Paddy Specialist and Sri. C. Ramaswamy, Deputy Director of Agriculture, IV Circle, Coimbatore. Their uniform courtesy and personal interest are gratefully acknowledged.

The Nizam Sugar Factory Plantation.

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Introductory. In the course of the last decade, India has been able to become self-sufficient with regard to her sugar requirements. But South India is far behind in contributing her proportionate quota of sugar as the number of sugar factories and large scale sugarcane plantations are few. The Nizam Sugar Factory Ltd., however, satisfies a longfelt need in the Hyderabad State.

This sugar factory is situated at Bodhan one hundred miles distant from Hyderabad city (Deccan). It possesses an extensive cane estate of about 8000 acres. The area is not a contiguous block but extends on the eastern and northern directions of the factory the farthest points being about seven miles in either direction. Of the total estate only about 3000 acres are planted every year. All the area is cultivated under the Nizam-Sagar project, one of the biggest in India. In this paper, an attempt is made to give a brief account of the plantation side of the sugar factory.

Soil. The soil varies from light red loams to medium and heavy black soils with a porous morram or light black subsoil.

Climate. Average rainfall is about 35—40 inches most of which is received during the South west monsoon. A few intermittent heavy showers, occur during the North west monsoon. The altitude of the place is about 1200 feet above sea level.

Varieties of Cane. The varieties that are chiefly propagated at present in the estate, are P. O. J. 2878; Co 290; Co 419; E K. 28 and H M. 230. Of these P. O. J. 2878 gives a very good yield in red loams provided all cultural operations are done properly and in time. Co. 290 is very useful in alkaline and in black soils; Co. 419 is very promising particularly in black soils and the area under this variety is gradually increasing. Out of 3000 acres, P. O. J 2878 occupies half the area; Co. 290 occupies 1000 acres and the other varieties are planted in the rest of the area.

Rotation. The usual rotation is sugarcane sugarcane-fallow or green manure crop. Except growing green manure crops like sunnhemp no other crop is grown in rotation. The general principle is that the total area should be $2\frac{1}{2}+3$ times the standing crop. Since there are 8000 acres, every year about 3000 acres are planted. Where soils are good a ratoon crop is raised. Otherwise the land is ploughed and planted again either in the season or in the next according to the fertility of soil.

Seasons. There are two seasons for planting cane. The first planting is done after the receipt of the first monsoon showers from June up to August-September. This will mature in October of the succeeding year. This is called the *Adsali* or eighteen month crop. The second season is from November to January. It is called the *Ekasali* or twelve month crop. Planting after February is inadvisable because it increases borer attack. In the factory estate, of the 3000 acres, *Adsali* plantation occupies 2000 acres, *Ekasali* 500–600 acres and the rest of the area is ratoon. This major portion *Adsali* comes handy to the factory in early October, for crushing.

Cultivation. Three agencies are in operation human, animal and machine. Machinery is used for preparatory cultivation. All cultural operations are done both by bullock power and manual labour according to convenience and cheapness.

Preparatory Tillage. The land is first tractor ploughed by a heavy plough or subsoiler to a depth of 12–15 inches. If there are ridges of the previous crop, a heavy disc harrow is passed over to break the ridges and then the soil is ploughed. After leaving the field for weathering for a few months or weeks (as the case may be) a cross ploughing is done. After a week or two, disc harrows are passed over to pulverise the big clods and bring the soil to optimum tilth. Finally a two to three furrowed ridger which makes furrows and ridges at 3 ft. 6 inches or 4 ft. apart and 20 inches deep is passed. Planting is done in these furrows. Harrowing and ridging are done by light tractors while ploughing is done by tractors of heavy type. Up to this stage, all operations are done by machinery.

After ridging by tractors manual labour is employed to remove old stubbles, to do local levelling within furrows and to rectify ridges so that they may be straight and uniform. Then cross drains (1 ft. × 1 ft.) are excavated at convenient distances of 33 feet or 40 feet and the whole field is divided into regular blocks of convenient dimensions, say 8-acre blocks. Each block is surrounded by drains and field roads. Drains and surrounding gutters are dug to collect run-off water from each block and carry it to a place beyond the entire field. Also deep subsoil drains are dug wherever necessary, particularly in black soils, to drain off subsoil water and thus prevent accumulation of salts which in the long run may lead to alkalinity. Good drainage is an important factor in cane cultivation. Each eight acre block is again subdivided into half acre blocks by strong bunds and cross-bunds. These will facilitate storage of water in the summer season. Field

channels and sub-channels are excavated from the distributary according to the level of the land.

Planting. Throughout the length of the furrows, grooving from 3 inches to 4 inches depth is made by a curved type or *Konki* made of wood, in the middle of the furrow, just a little high on the side according to the season. A slight dose of ammonium sulphate or super phosphate is spread in the grooves. After preparing beds in the above manner an irrigation is given if there is no rain. Healthy setts free from stem borer, red-rot etc. and which have good healthy green eye-buds are selected. As a precautionary measure they are dipped in Bordeaux mixture. Ten to fifteen thousand setts each with three eye buds are selected and placed end to end in the grooves keeping the eyebuds on one side of the groove and then covered by a layer of earth. The small dose of manure serves as a starter for the young germinating shoots. After planting, an irrigation should be given unless there is rain.

After-cultivation. In two to four weeks all the buds germinate and young shoots sprout up. One mulching is given at this stage to hasten germination. After a month, if there are any gaps owing to failure in germination, fresh setts or young plants are planted. Within a period of two months, three or four mulchings are given by curved tynes or blade-harrows. The field is always kept free from weeds. Concentrated manures in the form of ammonium sulphate and castor or groundnut cake are given in two or three doses with an interval of one or one and half months between each application. Deep grooving throughout the length of the plant furrows is done before each manuring and manure is applied as deep as possible so that the roots may go deeper and tap the subsoil layers and not become lateral and feed on the surface soil. The oil cake is well powdered and mixed with ammonium sulphate before application. After each manuring a portion of the ridge is cut off and the plant is well earthed up to the collar. This will prevent borer attack and also encourage tillering. The final manuring is done five to six months after planting. Along with it the final earthing up is done by which operation the previous ridges are converted into furrows and furrows into ridges. The shoot portion is covered to about one to one and half foot height and the furrow is made one foot deep from ground level. Then bunds are formed in each half acre block so that water if left in the first furrow may flow to the last in a zig-zag manner without any interference. Where the level is not uniform and gradual, but steep and sudden the half acre block is further divided into two or four sub-blocks. Each sub-block is bunded strongly and beds made so that irrigation is done very efficiently and economically. No wrapping or propping is done for the crop. The crop is heavily earthed up to prevent lodging to a certain extent. Copious irrigation and free drainage are practised.

Manures and Manuring. Sugarcane is a crop that responds well to liberal manuring. Systematic green manuring during fallow and additions

of all available compost, farm-yard manure and poudrette before and after planting are beneficial to the crop. Molasses and press cake by-products in sugar manufacture are profitably utilised by their application to the soil during fallow and ploughing them in after a shower. This is specially useful for reclaiming alkaline and saline lands. Besides these, nitrogen, potassium and phosphorus are given in the form of oil cakes and ammonium sulphate. Superphosphate is specially used in alkaline patches. The usual quantity of manure is 2 cwts. of ammonium sulphate and $2\frac{1}{2}$ tons of castor or groundnut cake given in 3 or 4 doses in the same proportion of 1: 10 (nearly).

Pests and Diseases. Fortunately in this tract red rot and mosaic which have proved the bane of cane crops in several parts of India are still unseen and it is hoped that with a little care in the selection of material at planting time, these can be prevented in the future. Stem borer *Diatraea sticticrospis* and top borer *Scirpophaga nivella* are frequently found to infest cane in this tract. Their attack is minimised by timely planting and by copious irrigation during summer. Moths are collected at night by light traps, on a mass scale.

Pyrilla purpusella is another pest which makes frequent visits. It is found to be harmless if it attacks a grown up crop but in young plantation its damage is considerable. Bagging and other remedial measures are done to lessen the damage to the crop.

Striga lutea, Striga densiflora and *Striga euphrasioides* are rampant in the tract specially in black soils. All the sorghum fields have been brought under cane cultivation since the inception of the project. Therefore striga proved devastating in the initial stages. Regular and timely intercultural operations, uprooting the weed and preventing the plant from flowering whenever it appears in any nook or corner of the field have been successful in keeping the weed under control. This method of dealing with the parasite was expensive in the initial stages but all the same the experience at the place shows that the weed can be brought under control within a year or two.

Harvesting. Twelve or eighteen months after planting according to the season (*Ekasali* or *Adsali*) the crop is harvested after testing for maturity of the crop. From September onwards at regular intervals samples of cane are taken to the factory laboratory and tested for maturity. After the chemist certifies that the canes from particular fields have become mature to give good recovery, those fields are harvested. Harvesting is done by cutting the canes by a cane cutter to the bottom most portion or by uprooting the stools by crowbars. Then the canes are stripped of leaves, cut into bits of convenient size, 20–30 sticks made into a bundle and sent to the factory by carts or lorries or by factory's own railway line.

With cultivation on scientific lines an average yield of 40–60 tons for Adsali crop and 25–40 tons for Ekasali is obtained in these lands. After

harvesting, the same field is kept as ratoon without planting again, from which 15 to 20 tons yield is obtained. One ratoon can be profitably kept in rich soils while a second ratoon even in fertile soils is inadvisable as it will harbour pests. In a sugar factory estate it is not possible to have an alternative crop like paddy in rotation. Therefore after one or two successive crops the land is kept fallow and green manures are grown and ploughed in.

Acknowledgements. I acknowledge my grateful thanks to Mr. Tarapore, the General Manager and Mr. Haquani, the Assistant General Manager of Nizam Sugar Factory Ltd., Bodhan, for their guidance in the preparation of this paper.

Appendix.

Cost of cultivation of sugar cane per acre of Adsali or 18 months crop.

Preparatory Cultivation.				
Ploughing by machinery:—				
Double ploughing, harrowing and ridging	Rs.	25	0	0
Preparing beds:—				
Making plot bunds	Rs.	2	0	0
" field channels	Rs.	2	0	0
" field drains	Rs.	3	0	0
Dressing of furrows	Rs.	3	0	0
Seed and sowing:—				
Harvesting for seed (a) Harvesting stripping etc.	Rs.	0	12	0
10000—15000 setts. (b) conveying into field for 2½ tons...	Rs.	0	8	0
Cost of seed (2½ tons @ Rs. 20 per ton)	Rs.	50	0	0
Planting	Rs.	4	0	0
Weeding: 3—4 times. 1st and 2nd weeding @ Rs 1—8—0 each and 3rd and 4th weeding @ Re. 1 each ...	Rs.	5	0	0
Mulching and hoeing—4 times @ Rs. 1—4—0 each ...	Rs.	5	0	0
Manuring:—				
Cost of manure—2 cwts of Ammonium sulphate @ Rs. 11 per cwt.	Rs.	22	0	0
2½ tons of oil cake @ Rs. 55 per ton	Rs.	88	0	0
F. Y. M. compost, green manure etc.	Rs.	10	0	0
Application of 3 doses @ Rs. 1—8—0 per application Rs. 4—8—0 powdering cake and conveying within field as. 8 per application.	Rs.	6	0	0
Irrigation:—				
35—40 times in red soils 20—25 in black soils ...	Rs.	24	0	0
Maintenance of drains and field channels	Rs.	2	0	0
Harvesting a 40 tons crop and transporting up to factory site @ Rs. 2 per ton ... ... 0—12—0 for harvesting and stripping, 0—4—0 for conveying up to rail site Re. 1 Loading in bogies and cost of transport (per ton)	Rs.	80	0	0
Assessment (including watercess)	Rs.	48	0	0

Supervision charges:—

1 supervisor Rs. 75 3 fieldmen Rs. 75 6 maistires Rs. 72	per month for 300 acres.	...	Rs.	13	5	0

Miscellaneous:—

Watchmen	...	...	...	Rs.	3	0	0
Pests and diseases control	...	...	...	Rs.	5	0	0
				Total Rs.	401	9	0
				or Rs.	400	0	0

40 tons crop valued @ Rs. 13 per ton.	Rs.	520	
Expenditure.	Rs.	400	
Profit.	Rs.	120	per acre.

For Ekasali (12 months crop) the margin of profit will be reduced to about Rs. 70 while for ratoon it will be Rs. 50 nearly.

Note. All the above calculations are done in terms of O. S. Rupees. 116 O S. Rupees are equivalent to Rs. 100 in British Indian currency.

SELECTED ARTICLE

Economic Factors in Agricultural Development.*

By K. C. RAMAKRISHNAN, M. A.

(Continued from Vol. xxix, p. 197).

III. Effects of Land Tenure and Taxation. Conditions of tenure and taxation of land play an important part in promoting or impeding agricultural improvement. For more than a century in Great Britain leadership in farming was in the hands of landlords who had enlarged and enclosed their estates by buying off the numerous strips of yeoman farmers, often with the profits made in trade and invested capital in long-term improvements like drainage works and farm buildings and did pioneer work in the cultivation of better crops and the breeding of pedigree stock. It is the success of these ventures that made Britain the pioneer of modern agriculture, as well as of large-scale manufactures. This period of prosperity lasted for over a century—from 1750 to 1870. After 1870, however, American competition killed cereal farming; there was a continuous fall in rents, while the cost of cultivation, particularly wages, increased. Arable farming gave place to grass farming and stock-raising. Industries were more paying than agriculture, Industrial magnates bought land more for its amenities and social prestige than for its profits as a farm enterprise or for the love of agricultural research. Research indeed passed into the hands of several specialists and it was beyond the capacity of any landlord to set himself up as a leader in science or technique, Continuous increase in income-tax and death duties led to the break-up of big estates and many old farmers became, in the first thirty years of this century, occupying owners with the help of the State. But a decade of falling prices has impoverished these owners too, who have little capital left to work their farms. Small holdings in certain specialised lines of agriculture like dairying, fruit culture and vegetables are still favoured, but for staple cereals large scale mechanised farming with State ownership of land and control of cultivation is advocated.

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It is strange that when such radical changes have been going on in Britain for many years now, so many British administrators coming over to India even in recent years should harp upon the British tradition of landlord-leadership in scientific agriculture and appeal to the landed aristocracy in India to give a lead in agricultural improvement.

We can understand Lord Cornwallis, the author of the Permanent Settlement in 1793, expressing the hope that the zamindars (in Bengal) would exert themselves to spread and improve cultivation in their estates, of which they had just then been made proprietors and assured immunity from enhancement of *peishkash* which they had agreed to pay. He had evidently in his mind the contemporary English 'improving landlord.' Some zamindars no doubt had the jungles cleared, canals cut, tanks dug, and temples and ghats built. The area of cultivation was extended. But there were few zamindars either in Bengal or in other provinces, where the Permanent Settlement was soon after introduced, who took any active interest in cultivation, even on their own home farms, of the better types of crops with better implements and fertilisers or in the improvement of livestock, the breeding and rearing of which were carried on by backward tribes. Most of the zamindars went on rack-renting with the growing competition for land, using their power to evict tenants as a lever to enhance the rents. Even after the enactment of tenancy laws, the provisions for the commutation of kind rents, for the occupation of old wastes, and the summary recovery of dues were all abused to such an extent that tenants have been crying for reduction of rates to the levels prevailing in neighbouring ryotwari areas, which are themselves quite high.

The abuse of the system reached its worst in Bengal, where most of the zamindars became absentee landlords and a series of intermediate tenure-holders with rights of their own have sprung up between the zamindars and the actual tillers of the soil. The ryots in other zamindari tracts too are not all cultivators; many of them let out their lands, of which they have now occupancy rights, to impecunious labourers for a fixed or sharing rental. Such a dissipation of interests in cultivation is not conducive to any improvement in agriculture.

Nor are all the ryots in ryotwari areas cultivating their holdings. Big as well as small ryots have mostly fragmental holdings; little or no attempt is made to consolidate and improve them; and the different fragments are generally sub-leased to different petty tenants-at-will, most of whom live on the margin of subsistence. Those who cultivate on the *varam* or crop-sharing tenancy system —analogous to the metayage in Europe—either as tenants of zamindars or of ryots have the least incentive to effecting any improvement. Where, however, fixed cash leases are the rule, as in the case of valuable commercial crops, and the tenants are men of resources and spirit of enterprise, they invest capital in the purchase of better seeds and manures. Except in the case of tree crops, as in Malabar, such tenants are not anxious to stick to the cultivation of particular pieces of land. They move from one land to another paying rents according to soil, irrigation and market facilities.

The Royal Commission on Agriculture pointed out incidentally—land tenure was outside the terms of reference—that large scale farming 'though open to many is practised by few'. Among the reasons given, tenancy legislation, the primary object of which was to confer security of tenure on ryots in the estates, is said to have rendered it difficult for large land-holders to obtain unrestricted possession of compact blocks of land But we wonder if many of them are yearning to practise scientific farming for the benefit of themselves and their ryots, after missing splendid opportunities to set up model home farms in the past.

Sir John Russell reviewing the progress of agricultural research and its application in India in 1937 lamented the lack of agricultural aristocracy

analogous to the British landlords or the large farmers, "rooted in the soil and ready to try any improvements suggested by experimental stations and anxious themselves to devise improvements, which are sometimes better than those of the experimental stations". Whatever the past might have been, recent investigations like those of Astor and Rowntree tell a different and distressing tale of large farmers in Britain.

In respect of dairy industry again, Mr. F. Ware, an authority on animal husbandry, has suggested that "the wealthy land-owning classes of the country might give their support by maintaining high grade herds of pure bred indigenous dairy cattle and by supplying approved sires for use in the villages."

Agricultural reform in other European countries took a different turn from that in England. After the Napoleonic wars, measures were taken to abolish serfdom on land in most of the Western European countries; and the Code Napoleon established equal inheritance of land among all the sons of a father. With the growth in population in the 19th century holdings naturally tended to become smaller in size. There were few landlords left of the type of English landlords, except in East Prussia. In fact the State offered little encouragement for the growth of big estates, while steps were taken to break them up and settle the workers as proprietors. Consolidation of fragmented holdings was effected by permissive legislation in most countries and the subdivision of holdings below the minimum economic unit was prevented by law. There was indeed little of the worship of the large estate as in England, though the economies of large-scale production and marketing were before long appreciated. Such economies were effectively realised by the variety of co-operative organisations, most of which were inspired by the spur of necessity to meet the American competition. It was found that in respect of production in certain lines, small holdings were by no means inferior to large ones, and much of the land was devoted to such specialities. The processing and marketing of such crops demanded more of co-operative effort, and hence it is that all over Western and Northern Europe, co-operation has been treated as a necessary complement to peasant proprietorship. For instance, in Denmark it is not the big farmer that is reputed to breed and rear good cows. More than 90 per cent of the herds consist of less than 15 milch cows each. Though Denmark took up the development of dairy breeds long after England, the red Danish cow is not inferior to any English breed in respect of yield of milk and butter fat. This has been achieved by the co-operation of the State department and the peasant co-operatives for milk recording etc. Progress has been achieved in smaller lines—in the production of oats, barley and potatoes by Belgian peasants and in the raising of wheat, fruits and vegetables by the Dutch peasants almost entirely by their multifarious co-operative organisations. Scandinavian and Baltic States achieved equally remarkable progress by co-operative methods. An agrarian reform amounting to a revolution was effected in Central and Eastern States of Europe after the last war by the conferring of ownership rights on cultivators and by the break-up of big estates, which were not fully compensated; and even here co-operation was called in to the aid of the new peasant proprietors.

With such splendid models before them of progress achieved by peasants co-operatively organised, we wonder why the British authorities should still go on appealing to effete landlords instead of earnestly helping to build up a sound, all round, co-operative movement, which has been the greatest instrument of agricultural progress all over Europe. Perhaps as Mr. L. D. Gammans of the Malayan Civil Service says: "The Englishman in the East is probably more ignorant of co-operation than most other Europeans. With the exception of

consumers' store, which does not appeal to any great extent to the educated classes from which the British official is largely recruited co-operation in Great Britain is little developed. The ordinary Englishman is apt to know little of its other possibilities and is less conversant with the co-operative organisation of agriculture than the German, the Dutchman, or the Dane."

Though peasant proprietorship is on the whole the best system of tenure in India where capitalistic or socialistic large scale farming is out of the question on account of the nature of crops, the scarcity of land and the abundance of labour, it is neither possible nor desirable to do away with tenant-farming. There are good cultivators who do not like to have their little capital locked up in the purchase of land, which is better used in working the farms that they take up for lease from time to time. An impartial tribunal that will fix up fair rents and compensate for loss for any premature eviction, combined with facilities for co-operative credit, supply and sale would for them be ample substitutes for the 'magic of property' in land.

In fact co-operative societies may be organised by tenants who can take on lease a large piece of land or several pieces from one or more landlords. Joint farming may be tried or at least an attempt may be made to consolidate cultivation units and each member may take charge of one unit. The bargaining power of such co-operative ventures will be greater than that of petty individual tenants competing among themselves. The advantage may not be on the side of tenants alone. Many an absentee landlord and institution owning land, not to speak of reasonable local landlords, would be pleased to deal with a well-knit co-operative organisation than with a number of poor tenants. Agricultural graduates can play a great part if they can organise and manage such societies taking on lease the lands of temples, endowed charities and institutions and the lands that have come into the hands of co-operative banks, insurance companies, etc., even as their confreres in America have organised themselves into agricultural management companies for a similar purpose. They can serve as managers and share the profits of the enterprise with all the working members. They can set a higher standard of cultivation and reduce the evils of a recklessly competitive and wasteful tenancy system.

Land revenue in ryotwari areas, assessed on the theory of State landlordism and revised only in 30 years, was felt to be a heavy burden even in periods of rising prices. It is certainly oppressive in a period of falling prices and intolerable in years of drought, when remissions are by no means liberal. At any rate the rigidity of the rate with no automatic provision for remission in years of scarcity of rains, or of fall in prices, is not conducive to the investment of capital in agricultural improvements except of the kind, like sinking of wells for which provision has been specially made for exemption from enhancement of rates. This exemption has surely given a great fillip to the digging of wells and the mechanical lifting of water in some districts. The exemption need not indeed be permanent, but may be reduced to a period of 30 or 40 years as in the Punjab, without detriment to improvements.

The comparatively well-off ryots dissipate their extra earnings got in years of better yield or higher prices, or divert them to the purchase of more land rather than invest them in any substantial improvements on the land they already have. Agricultural experts should look for such opportunities and induce such earnings to be invested in improvement of land or purchase of plant like the water-lift, tractor-plough, cane-crusher etc.

Land revenue is said to be a tax on land and not on persons and is being imposed on all alike. It is a regressive tax pressing unduly on the poor, who have in good years little left to spend on improvements. Taxation of higher

agricultural incomes, over and above a reduced flat rate of revenue, is bound to be introduced in all provinces, as it has already been done in Bihar and Assam. With a view to encourage greater productivity on land, concessions may be shown for improvers of land and crops by making liberal allowances for expenditure on improvements of approved types.

The existing system of taxation of water is not scientific and it leads to a lot of waste of water and injury to the land. But volumetric taxation of water would be costly to administer without a system of co-operative distribution of water among the users Exemption of charges now granted for the use of water in growing green manure crops may well be extended to use of water for raising fodder crops in areas with a deficiency of fodder. A part of the local land cesses now spent by local bodies on a variety of objects may be earmarked for agricultural improvements by the organisation of propaganda, demonstration and systematic instruction by itinerant teachers employed by District Boards, even as County Councils are doing in Great Britain.

Export duties on manurial resources like oilseed, bones and fish have been time and again recommended by agricultural experts with a view to bring down their prices and induce greater use within the country, so as to conserve soil fertility and produce better yields. Such duties might in the first instance hit producers of such materials, though the merchants would be hit more; but in the long run they would stand to gain by greater demand within the country and the reduction of middlemen's profits in internal trade.

Import duties on competing foreign produce with a view to stabilise the prices of home produce have been freely resorted to in almost all European countries. But for over a century the free trade policy of Great Britain has stood in the way of any similar protection to her crops, and incidentally to our crops too even when the need has been felt for it in recent years. South Indian producers, having to incur greater costs of cultivation on older soils and irrigated lands, have been crying in vain for protection from Burma and Siam rain-fed rice and Ceylon plantation copra. The greatest and the most successful departure from free trade tradition has been made in the case of sugar—though more in the interests of manufacturers than of cultivators—and this accounts for the sudden expansion of sugarcane area even in South India, which really is better fitted to grow cane than North India, but suffers from want of factories to absorb the canes grown. An extension of such protection to other crops may be opposed on the score of the poverty of consumers. There is also the danger that it may remove an important spur to improvement; for the temptation to go to sleep behind the tariff wall is greater in this country.

This course of lectures, it is hoped, has brought out the dominant importance of the economic factors in the development of agriculture, which educational and research workers will have to take into account. Nowhere has the importance of agricultural economics been so well recognised as in the United States. It would, therefore, be fitting to conclude this course with an extract from a statement made twenty years ago by H. C. Wallace, the famous Secretary of Agriculture, who organised the Bureau of Agricultural Economics.

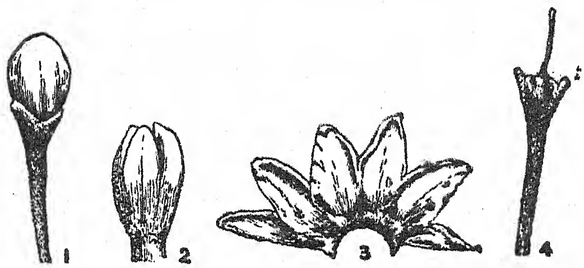
"Help in their economic problems is now the most urgent need of our farmers. This is not to say that the Department is losing sight of production matters. The farmer needs all the help in his production problems that the Departments of Agriculture, Colleges and experimental stations can give him; but the need of the most importance now is the development of an entirely new realm of organized knowledge bearing upon the economic factors of agriculture, looking towards cheaper production, improved methods of distribution, and the enlargement of markets, all to the end that the prices the farmer receives shall be more fairly related to his cost of production."

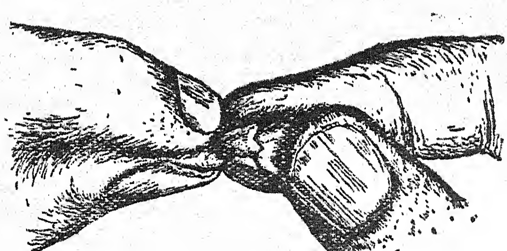
Jou. Mad. Univ. Vol. 29, Jan. 1941.

Research Notes.

Emasculation in Chilli (*Capsicum annuum*).

Emasculation, the first and the most important operation, to be attended to during the process of hybridization entails a good lot of care and vigilance on the part of a plant breeder. Often it is done by completely removing the stamens one by one with a pair of forceps or scissors, before the anthers begin to burst. This method of removing the anthers takes time and often, inspite of the several precautions taken, one or more stamens are left in the flower, specially in those where several stamens have to be removed.





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1. Chilli flower bud ready for emasculation. 2. The tubular corolla removed. 3. The corolla spread out showing the epi-petalous stamens. 4. The gynoccium as left intact after removal of the corolla. 5. A view of the process of removal of the corolla.

In chilli the stamens are all epipetalous, and the corolla is so brittle that the tubular corolla can easily be removed without any injury being caused either to the ovary, the style or the stigma. When the fully matured bud, which is expected to open the next day, is slit at the corolla to remove the anthers one by one, it was found that in some cases the tubular corolla came off easily leaving the gynoecium intact. This led us to try if the epipetalous corolla tube cannot be removed wholesale instead of attempting to remove the stamens one by one.

The pedicel of the flower is held between the thumb and the forefinger of the left hand, having a careful and firm grip of the calyx enclosing the style and the stigma. It is quite gratifying to note that this method of emasculation gave as much percentage of setting as the usual method of removing anthers by

forceps etc. and one great advantage was saving time. Detailed data regarding the number of flowers that could be operated in a fixed time by both the methods and the percentages of setting are being collected. Even illiterate coolies, specially women were able to do this operation with the greatest amount of confidence giving a very good percentage of setting. Preliminary trials were conducted with tobacco flowers also where the results are quite encouraging. The method appears promising for most epipetalous flowers.

Agricultural Research Station, Guntur.
1st. May, 1941.

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ABSTRACTS

The Control of Lantana by a Sodium Chlorate Spray. Griffith A. L. *Indian Forester* 47 (1941): 107-114.

Lantana is a well-known troublesome weed in many parts of Madras province, especially in the West Coast districts, Coorg, parts of Nilgiris and hilly parts of many other districts. Some experiments on the control of this weed with chemical sprays are being conducted by the Madras Forest Department. Several chemicals were tried including sulphuric acid, copper sulphate, Atlas tree killer, arsenic acid and sodium chlorate. Of these, the most effective and at the same time economic method is the use of three sprays of sodium chlorate at intervals. The solution is prepared by dissolving ½ lb. of commercial sodium chlorate in one gallon of water. Two ounces of casein are added as a "spreader". A little slaked lime or a pinch of soda is sufficient to dissolve the casein in water. The first spray is best done about February at the commencement of the hot weather and consists of 24 gallons of solution sprayed evenly per acre. Withering of leaves is seen on the same day and within 5 to 7 days all leaves completely wither and the top twigs dry up completely to a length of 3 to 4 feet. The second spray of 8 gallons is done in April about three months after the first spray, when the regrowth and the seed germination are complete. The second spray kills most of the regrowth and the new germination but in some cases a third spray is necessary as some of the older stumps give rise to weak basal shoots. The third spray consists of about 2 gallons per acre and is done about September or October i. e. roughly 9 months after the first spray. If the cleared area is left as it is, it takes two to three years before birds and animals have brought back the pest. The total cost of these operations (at pre-war prices of the chemical) is estimated at Rs. 10 per acre which compares favourably with other successful methods viz. Rs. 15 for girdling the stems and poisoning them with arsenicals or Rs. 13–8–0 for cutting and burning the growth and controlling regrowth with sodium chlorate spray. K. C. J.

Does Fertilizer Affect the Arrowing of Cane? H. W. Kerr, *Cane Growers' Quarterly Bulletin, Queensland*, 8 (1940): 76.

Inspection of a field that had received various fertilizer treatments showed that the percentage of arrowing was abnormally high on some of the plots, and that this difference had some relation to the differences in fertilizer treatment. Counts were therefore carried out and figures obtained in respect of the individual fertilizer treatments. The results showed that where the cane received no sulphate of ammonia fertilizer, the percentage of arrowed stalks was 71; where 200 lbs. sulphate of ammonia per acre had been applied, the percentage of arrowing was 54, and where 400 lbs. sulphate of ammonia had been used, the percentage was only 11.

These figures illustrate strikingly the influence of sulphate of ammonia on the degree of arrowing of the crop and emphasize the importance of applications

of the correct manures in the correct proportions for best results. A stalk which has arrowed can make no further growth (except by "side shooting"), no matter how favorable the growing conditions may be. In a favorable spring season, unarrowed stalks may take advantage of beneficial growing conditions until they are harvested.

Varying amounts of phosphate and potash were also included in the experiment referred to, but these plant foods appear to be without influence on arrowing. (*Facts about Sugar* 36 : 39).

Sheep breeding research in India—Sahahi, H. B. *Indian Farming* 2 (1941) : 61—65. According to the Livestock census of 1935, there were over 25 million sheep in this country, of which 12 million were to be found in Madras, first in rank in India. The Indian sheep industry, if systematically organised and developed. is capable of yielding far better returns. There have been in the past a few spasmodic and intermittent efforts to improve sheep breeding, but no account is available of the progress made or why the efforts were abandoned. Some cross-breeding experiments were conducted with imported rams. There was an increase in the wool yield from 1½ to 7 lb. per head, per annum. Nothing could, however, be done to stop the tendency of the cross-breeds of the second, third, and fourth generation to lose size. The Imperial Council of Agricultural Research, has now taken interest in this question and schemes are financed in Madras, Punjab, Bombay, Kashmir and Mysore. The details are as follows:— (a) *Madras.* The lambs of the Bellary breed consist of black-faced lambs and a few white-faced lambs. The latter are delicate in constitution and cannot stand up to adverse conditions. The object of the breeding research is to raise a flock which will yield 4 to 5 lb. of wool per sheep, per annum. It is also proposed to use rams of Bikaner breed, with the hope of producing a breed which will not only yield more and better wool but also respond to feeding and fatten easily. The other items of study are, the effect of two lambing periods in a year on the constitution of the ewes, the best time for castration, the effect of shearing twice on the wool yield. (b) *Punjab.* Systematic improvement of Bikaner breed is in progress at Hissar. The best methods and times of mating, docking, shearing and castration are being ascertained. A study of the effects of washing on the growth of wool is also in progress. (c) *Bombay.* Studies are made on mating, shearing, docking, castration of Deccani flock and the husbanding of grazing resources. The work carried out so far has shown that the Merino is adaptable to the Deccan environment but certain precautions are necessary. The best time for docking is found to be when the lambs are 14 days old. (d) *Kashmir.* Cross-breeding experiments are proposed to be conducted with selected local ewes and imported rams. (e) *Mysore.* Special studies will be undertaken on the relation of feed to quantity and quality of wool, longevity and wool production of the mother and progeny and the effect of castration on mutton and wool, etc. The scheme relating to analysis of wool is being undertaken by the Technological Department of the Bombay University. It will be a news to many to learn that Australia built up its present world renowned wool trade from a foundation stock of Indian sheep. The Merino is stated to owe its origin to the fat-tailed Dumba of Northern India. There seems no reason, therefore, why India should not follow the example. M. K. R.

Eleven years' results of continuous manuring of Paddy at Mandlay U-Tin. *Ind. Jou. of Agr. Sci.* 11 (1941).

The object of the experiment was to study the influence of various manures on the soil of the Mandalay Farm and in particular the manner in which the soil fertility is affected by repeated applications of chemical and organic fertilisers The different manurial treatments were (a) lime, 5 cwt. CaO per acre once in 4 years (b) sodium nitrate, 40 lb. N_2 per acre (c) Ammonium sulphate

40 lb. N per acre (d) superhosphate 40 lb. P_2O_5 per acre (e) bonemeal, 40 lb. P_2O_5 per acre (f) Potassium sulphate 40 lb. K_2O per acre. (g) Ammonium sulphate 40 lb. N_2 per acre plus superphosphate, 40 lb. P_2O_5 per acre (h) Ammonium sulphate, 40 lb. N per acre plus superphosphate 40 lb. P_2O_5 per acre plus Potassium sulphate 40 lb. K_2O (i) Farm yard manure, 40 lb. N per acre. The manures were applied shortly before transplanting. The plots are irrigated, the average rainfall being only about 33 inches. The soil is a heavy black clay of the carbonate solontschak type having a pH of about 8·05. All the manures except lime, bonemeal and potassium sulphate show significant increases over the untreated plots. Of the effective manures sodium nitrate is just significantly better than no manure, while ammonium sulphate alone is very much better than sodium nitrate but inferior to all phosphatic manures and to farm yard manure. Superphosphate alone, though inferior in yield to the two manurial combinations, has given a greater increase in yield from year to year. The three manures applied on a nitrogen content basis differ from one another significantly. From the mean yields it seems that nitrogen in organic form is the best while nitrogen as ammonia comes second. The results of this investigation on the effects of cumulative doses of various manures in relation to the corresponding control have been summarised as follows:— (a) it has been observed that the relative efficiency of manurial treatments shows significant variations from year to year. (b) Of the three nitrogenous manures, organic manure is the best with respect to the yield of paddy grain, while ammonium sulphate is much superior to sodium nitrate. (c) Bone meal shows no significant increase. This was to be expected in a soil of about pH 8·0. (d) It has been observed also that of all artificials only superphosphate applied alone at the rate of 40 lb. P_2O_5 per acre has shown a significant upper trend. (e) Farm yard manure shows a similar effect to superphosphate, though not so highly significant (f) Sodium nitrate and ammonium sulphate show negative trends The former's trend is quite insignificant but that of the latter only just fails to reach significance. (g) The combined manures ammonium sulphate plus superphosphate and ammonium sulphate plus superphosphate plus potash show positive trends, but they are quite insignificant. It is suggested that the negative effect of ammonium sulphate has largely counteracted the significantly positive effect of superphosphate K. R.

The effect of pruning at varying ages upon the yield of Ramai Rice. Ramon D. Rojas (*The Phil. Agri. Jour.* 29 : 1941 ; pages 851—860).

There is a popular belief among the farmers of the Philippines that pruning the leaves of rice seedlings would increase the yield of the crop. If leaf pruning has really the effect it is believed to have, it can become one of the most economic ways of increasing the yield, with the added advantage that it will provide the farmers with feeding materials for their work animals in the form of rice tops to supplement the rice straw which constitutes the main feed before the crop is harvested. The objects of the present study were : (a) to determine the relative effects upon the yield of Ramai rice of cutting off the leaves of the rice plant at different ages: (b) to find the age of plants at which cutting off the leaves would give the best yield and (c) to determine the influence of cutting upon the dates of flowering and maturity. The average duration of the variety under trial was 180 days-sowing to harvest—and the transplanting was done when the seedlings were 40 days old. The experiment consisted of the following treatments (1) control—(no pruning at any stage) ; (2) pruned at transplanting—no pruning later ; (3) pruned at transplanting and 60 days later ; (4) pruned at transplanting and 75 days later ; (5) pruned at transplanting and 90 days later. The following conclusions have been drawn from the results of the experiment : (1) Lodging occurred immediately before and after planting in all the control

plots, although the degree varied. A higher degree was observed in plots where there was more water. In plots where the plants were topped when relatively young, they lodged about two weeks after blooming, whereas in plots where they were topped when old they lodged only just before harvesting. (2) Pruning the leaves affected slightly the dates of blooming and maturity. (3) Cutting the leaves in young plants not more than 115 days after planting increased the yield of grain. Thereafter, the yield decreased. The plants pruned at 100 days of age gave the highest yield; the plants that were pruned (seedlings) just before transplanting and that had no subsequent topping gave the second highest average. The third highest yield was obtained in the 115 days old treatment with an average computed yield. The last treatment which was pruned at 130 days of age was the lowest. (4) The difference in yield between 100 days old treatment and control was highly significant. The same was true of the 130 days old treatment and the 100 days old. Other comparison with significant differences are 130 days and the control; 130 days and 40 days; 100 days old and 115 days; 115 days and 130 days. All others were insignificant. (5) The highest computed net gain was obtained in lot III—100 days old. The second was obtained in lot II. The other lots received less. (6) Based on the results obtained, it may be concluded that under conditions existing in Los Benos pruning the leaves of rice at an early stage of development would be profitable, because, besides the increase in yield, the cut tops represent an additional gain since they can be used as fresh succulent feed for animals. K. R.

Gleanings.

Unscientific Potato Storing Involves Enormous Losses.

Agricultural Marketing Adviser's Report. Losses incurred owing to unscientific methods of storing potatoes, particularly seed potatoes, are described as enormous, in the report on the marketing of potatoes in India and Burma, issued by the Agricultural Marketing Adviser to the Government of India. The Report estimates the annual loss in storage and during the process of marketing at 8,553,100 maunds valued at Rs. 1,65,79,000. The percentage of loss increases with temperature. In five months, the loss due to the transpiration and respiration processes alone at a temperature of 60 degrees Fahrenheit is 11·56 per cent. The loss would be still greater at a higher temperature at which potatoes are normally stored in India. So heavy are their losses that cultivators have to take special pains to carry over the stock of seed potatoes from one season to another. In certain cases, it is almost impossible to preserve the seed potatoes from one season to the next. This loss in storage seriously affects prices aud militates against a reduction in the cost of production.

Seasonal rise in Prices. Although the seasons of harvesting in different parts of India overlap to some extent, considerable gaps remain, rendering it necessary for growers and merchants to store potatoes in order to meet the demand in the off season. The seasonal rise in the price of potatoes is a well-known tendency. During February and March, they sell at Rs. 1—8—0 to Rs. 2—8—0 per maund but from July to November prices go up to nearly double. The rise in the price of seed potatoes is even higher. At harvest time, prices range from Rs. 1—8—0 to Rs. 2—8—0 per maund, but after six months, prices go up in most of the markets, particularly in the United Provinces, Bengal, Bihar and the Punjab from Rs. 5—0—0 to Rs. 14—0—0 per maund.

Why prices rise. In spite of such high prices, however, merchants and growers who store potatoes do not make much profit as more than 50 per cent is generally lost during storage. If this loss could be reduced, prices would not

rise so steeply, producers would obtain seed at a cheaper rate, and costs of production generally would be reduced. The problem of storage, the Report continues, is rendered difficult by the fact that the main crop is followed by a long and hot summer, and it is necessary that proper arrangements should be made for storage under low temperature. The main problem is to protect stored potatoes from high temperature in the summer months. Cold storage facilities exist at the ports, but they are not generally availed of, except at Karachi.

Reasons for apathy. There are several reasons for this apathy, the Report states. "Firstly, people have not yet realised the advantages of cold storage and few have seriously thought of utilising the cold stores for storing a cheap and semi-perishable commodity such as potatoes. Secondly, the ports are at long distances from the main producing centres and the cost of transportation to the cold stores and rents for storage have been rather high. The importance of cold storage of potatoes is however being realised gradually and in recent years cold stores have been erected exclusively for potatoes in important producing centres such as Meerut, Sialkot, Patna and Jammu. In Sind, the main producing area is within a few miles of Karachi and growers have freely made use of the available cold storage facilities both for table and seed potatoes. The cold storage of potatoes on a commercial scale was started in Karachi as early as 1932. The prices of potatoes in most markets are low from January to May and high from June to November, the difference in some cases being as high as Rs. 2—0—0 per maund. Taking the cost of cold storage at four annas per maund per month, and the average period of storage at two months, the cost of storage at two months, the cost of storage *plus* other incidental charges, such as interest on capital, would come to about 12 annas per maund, which leaves a margin of more than a rupee per maund.

Greater Seed Potato Losses. Seed potatoes have to be preserved for six to seven months, and losses in their case are enormous under present methods. The differences in the prices of seed potatoes at harvest time and at planting time, ranging from Rs 2—0—0 to Rs. 9—9—0 per maund indicate the possibilities of using cold storage for seed potatoes. A considerable amount of research work has been done on the effect of storage temperature under the cold storage scheme at Poona, financed by the Imperial Council of Agricultural Research.

Advantages of cold storage. Potatoes fetch a very low price during the harvest season, and while growers would score from storing a part of their produce and releasing it to the market gradually, it is not always possible for them to do so under existing conditions. The grower does not have sufficient funds to finance his own produce and has to depend largely on money lenders and commission agents Apart from his rent, he has to meet many other financial liabilities after harvest. This results in an abundance of supply and a consequent fall in prices. A widespread use of cold storage facilities appears, therefore, to be the only way of regulating supplies and prices. (*Indian Information* 8 (1941) : 246)

* * * * * *

A recipe for fungus diseases. The following recipe is highly recommended in an English horticultural journal as being almost infallible for mildew, scale, mealy bug, red spider and thrips 2 oz. flowers of sulphur worked into a paste with water ; 2 oz. washing soda, ½ oz. common shag tobacco, and a piece of quick-lime the size of a duck egg. Pour them all into a saucepan with one gallon of water, boil and stir for ½ hour. Then let it cool down and become clear. Then pour off and leave the sediment. The mixture will keep a long time if kept closed up. When spraying, use the mixture undiluted. —*Jou. Jam Agr. Soc.* 44 (1940) 439.

Egypt Interested in Indian Tobacco. Egyptian firms and factories, which showed little interest in Indian tob..cco in the early part of 1940, have now begun to examine the question of importing Virginia flue-cured tobacco from India. Prospects are promising in view of the curtailment of other sources of supply and of the increasing popularity of Virginia cigarettes. Importers in Egypt have been introduced to exporters in India by the Indian Government Trade Commissioner, Alexandria. Much of course will depend upon satisfactory contacts to establish a good reputation for Indian tobacco and to make supplies according to samples. (*Indian Information* 8 (1941) : 242.) * * * *

Indian Tea. *India is the third* largest supplier of tea to the United States, the leaders in the trade being Ceylon and the Netherlands Indies. (*Indian Information* 8 (1941): 207). * * * * *

Potatoes. *The latest report* on the marketing of potatoes in India and Burma places at 8,553,100 maunds, valued at Rs. 1,65,79,000 the annual loss involved in storage and the process of marketing potatoes. The higher the temperature the greater the loss, says the report. (*Indian Information* 8 (1941) : 207). * * *

India Ships 3,000 Tons of Timber in Fortnight. To meet war supply demands nearly 3,000 tons of timber were shipped from India during the fortnight ending March 25, 1941. Capacity and output for lorry body building and nearly all branches of munitions are steadily increasing. The manufacture of field artillery tractors is to be undertaken in Government railway workshop. The chief orders received by the supply Department during the previous fortnight are jute webbing, cloth for anti gas clothing and khaki drill for Australia and numerous items of engineering and general stores for India. (*Indian Information* 8 (1941) : 238).

Correspondence.

To

The Editor, Madras Agricultural Journal.

A Ryot's Testimony.

The Madras Agricultural Department has extended its aid to the ryots by posting one Demostrator for each Taluk. It is regrettable that their acts and advices are being viewed with suspicion by a large section of the ryots who do not care to study facts and figures. I take pleasure in putting before the public the following experience to prove how in a tract like mine the sorghum strains of the Department can help the peasant.

The Agricultural Demonstrator, Kandukur supplied me with three varieties of Jonna viz. T. 1; T. 6 and M. 47-3 to compare with the local varieties. I gathered four local varieties and all the seven were sown in half acre plots of uniform fertility on the same day. Owing to the heavy rainfall which was more than 50 inches for the year and of which 10 inches were received after sowing, my trial resulted in very poor yields. But this seasonal factor did not affect the results, because all the strains were grown under the same conditions.

T—1 is the sweetest fodder and T—6 comes next. The grain of these two varieties is hard and does not produce as much husk as local varieties and the food also is sweeter than that of locals. In spite of the fact that these two varieties are more liable to attack by stem borer than others they excelled all in quality and quantity.

I appeal to my agricultural brethern to make use of this piece of evidence and regulate their professional efforts on modern lines.

Thumadu, Kandukur Taluk
Nellore Dt. 6-5-41.

Yours etc.
K. Sankaraiah.

Review.

Report on marketing of grapes issued by the Agricultural Marketing Adviser to the Government of India. Manager of Publications, Delhi. Re. 1—4—0.

The grape vine belongs to the genus *Vitis*. In India there are about 25 species of *Vitis*. The varieties which are grown on a large scale are *Kishmish* and *Haitha* in Baluchistan, *Bhokari* in Hyderabad state and Bombay Presidency and Tor and *Bedana* in North-west Frontier Province. In the Madras Presidency the variety commonly grown in Madura and Krishnagiri areas is known as *Patchai drakshai*. The variety grown in Penukonda is a blue grape resembling the Bangalore variety. In India, grapes are available practically throughout the year though heaviest supplies are from July to October. In Madras and Bangalore, two crops are obtained in a year.

The total world area of table wine and raisin grapes is estimated at over 21,000,000 acres, the most important grape producing counties being Italy, Spain and France.

	(in 1935)	
Italy	9,654	(in thousand acres).
Spain	3,983	„
France	4,047	„

The area of grapes in India is about 4,170 acres and practically the whole of the produce is consumed as fresh fruit.

Distribution.

Province or State	*Year.*	*Area in acres.*
Baluchistan	1936—1937	2,429
Bombay	1934—1935	957
North-west Frontier Province	do.	266
Madras	do.	250
Others less than 50 acres.		

The world production of all kinds of grapes in the year 1936 was 2,86,41,700 tons of which India produces 13,800 tons.

Percentage of All-India production.

Baluchistan	49 7
Bombay	35·8
Madras	4·8
North-west Frontier Province	4·4
Mysore	1·7
Others	3·6
	100·0

The seasons for pruning and harvesting in India are as follows ;—

	Pruning.	*Harvesting.*	
Baluchistan, N. W. F. P. and Sind	March	June	One crop.
	April	November	
Bombay, Madras, Mysore, Hyderabad	April, May	August, October	First crop.
Madras, Mysore	September, October	February, May	Second crop

The yield of grapes in certain centres in India is far above that of other countries, of the world. The yields of table grapes in some of the grape growing countries of the world are given in the following table.

Country.	*Yield per acre.*
	lb.
United States of America (California)	7,678
Australia	4,220
France	4,064
Spain	2,405
India.	
Bombay	11,160
Mysore	11 610
Madras	6,000
North-west Frontier Province	6,000
Baluchistan	6,325

India's supply of grapes is very inadequate and she imports from foreign countries nearly as much as she produces. The average quantity of annual imports of grapes in India during the period 1932—37 was 8,300 tons of which 98 per cent was obtained from Afghanistan, the other sources of imports being the United States of America, Union of South Africa and Australia.

Imports of grapes into India.

	1932.	*1936.*
	(in thousands of tons)	
India	7·0	9·4

The number of vines per acre varies greatly from province to province according to the system of cultivation practised, from a minimum of 40 vines to an acre in Krishnagiri (Madras) to a maximum of 700 in Nasik (Bombay).

Baluchistan	300 to 450 vines per acre
Bombay	700 ,, ,,
N. W. Frontier Province	160 to 200 ,, ,,
Madras	40 to 240 ,, ,,
Sind	300 ,, ,,
Mysore—local variety	135 ,, ,,
,, Imported varieties.	300 ,, ,,

The only country to which grapes are exported from India in an appreciable quantity is Burma. In the year 1935—1936 the amount exported was 2,194 maunds of which nearly 70 per cent was of Afghanistan and Baluchistan grapes.

In Baluchistan vines are grown in trenches 2½ feet deep running parallel to each other about 12 feet apart and the vines are trained on high ridges and therefore there is no need for wooden supports. In the North-west Frontier province the vines are trained on a low *pandal* of wooden poles usually 2½ to 3 feet above ground level. In the Bombay Presidency the vines are planted in parallel rows 7 to 8 feet apart each way and the vines trained on cuttings of *Erythrina indica* planted close to each vine. The crown is generally formed about 5 to 6 feet high. In the Madras Presidency the vines are trained on *pandals* supported by stone-posts or bamboo stakes and in some cases brick.

The heaviest bunch of grape (Trebbians) has weighed no less than, 26¼ lb. In England where grapes are grown in glass houses, a bunch of Black Hamburgh has weighed 21¾ lb. and a berry of this variety has measured 4½ inches in circumference.

In the Madras Presidency, the cultivation is confined to three districts viz., ... in these places in 1934—1935 was

estimated at 150, 80 and 20 acres respectively. In the Madura district the chief growing centres are Michaelpatti, Vellodu and Kamalavaram villages situated near Kodaikanal Road Railway Station. In the Salem districts the centres are Krishnagiri and Dharmapuri, while in the Anantapur district there is a small acreage in Penukonda.

Mysore has an area of about 50 acres (1934–1938) of which 85 per cent is in Bangalore and in the adjacent villages.

Generally vines start bearing in the fourth year but they get into regular bearing stage in the sixth year. The age of grape vines in India is said to be the same as that of a man. In Penukonda there are vines of about 40 years of age bearing well. High winds, rains and disease affect the yield, very much. In 1933, in Krishnagiri the mildew disease was very severe and the entire crop failed.

Prices. Official figures regarding the prices of grapes are absent. The only source is the irregularly maintained account books of commission merchants. Prices are fixed either for the whole produce before harvest or per unit of weight of the produce obtained. The growers can get much higher prices by selling the produce direct in the local wholesale markets than by selling the produce to pre-harvest contractors. The highest average price of Rs. 1,350 per acre was obtained in Bangalore and the lowest of Rs. 300 in Baluchistan.' In the Nasik, Kodaikanal Road and Krishnagiri tracts the average price per acre comes to Rs. 1,000, Rs. 845 and Rs. 355 respectively.

The growers are forced to sell their produce before harvest on account of pecuniary difficulties and the absence of a knowledge of marketing technique. The prices vary greatly from day to day, from year to year and from market to market. These enormous variations in daily prices create a serious marketing problem. A regular news service between producing and consuming centres and the provision of cold storage accommodation at important centres where excess supplies may be held over from one day to the next are very essential.

Preparation for the market. Much care and attention should be bestowed on how produce is prepared for the market. It is definitely better to clean and grade grapes than to sell them in mixed lots of bad, immature and good fruits. The system of 'topping' i. e. packing good fruits at the top and bad ones at the bottom of containers should completely be avoided. To reduce damage the bunches should be removed with a pair of secateurs and placed on trays with a smooth surface. The use of baskets which are very deep and which have a rough surface should be avoided since the berries get bruised. Soft, dry and inodorous packing materials such as paddy straw, rice husk, dry grass etc., should be used instead of leaves which generate heat during transit and damage the fruits. Cork dust is used as packing material for Australian, South African and Spanish grapes and saw dust for American grapes. While packing the bunches should be packed tight, otherwise they receive injury due to shaking. Due to bad packing the grapes do not remain in good condition.

Grading. Standard grade specifications for grapes grown in the Bombay Presidency and the North-West Frontier Province were fixed under the Government of India Agricultural Produce (Grading and Marketing) Act 1937. The results of experiments on grading and marketing grapes have definitely shown that higher returns are obtained by the sale of graded produce as against sales in the ordinary way.

Assembling. The system of assembling grapes by growers' associations is rare in this country. Two such societies are functioning in North-West Frontier Province and Madras Presidency and both these societies assemble the produce of their members, grade it for sale in different markets and the results achieved by them have been encouraging.

Transportation. The cold storage vans provided by the North-Western Railway have considerably helped in the distribution of grapes far and wide in the country. It is therefore desirable that similar facilities are provided by other railways.

Storage and Preservation. It is highly necessary to have cold stores in the important consuming centres where whole-sale markets are situated. In some in-land towns like Bangalore, Mysore, Hyderabad and Lucknow, cold stores have been erected. Irregular supplies at the consuming centres cause very high fluctuations in price. Hence there is a keen need for convenient storage facilities where excess supplies of one day can be held over to the next. Overseas grapes are kept in cold stores in port towns and released for sale as required. No attempts have so far been made for preserving and drying of grapes for the reason that the quantity of grapes produced now is readily disposed of in the green state. The manufacture of raisins, grape juice, vinegar etc. needs study and experimentation.

Finance. The commission agent plays an important part in the marketing of grapes. He finances the producers and the contractors and gives credit to the buyers. The village money lender also advances loans but charges high rates of interest. When the commission agents give advances to growers and contractors, the agreement entered into is that the entire produce is sold through them. Co-operative credit and sale societies might possibly be organised to give short term loans to producers and contractors who have become members of the societies. The system of granting loans for the development of fruit culture as is done in the Mysore State deserves the attention of other Governments.

In the Madras Presidency, loans on similar lines are granted under 'The Agriculturists' Loans Act' for planting fruit-bearing trees. In the United Provinces and the Punjab, fruit development boards have been organised with a view to advise members on technical matters, provide facilities in getting reliable plants, and arrange for the marketing of fruits of the members. Similar associations in other parts of the country would be of immense use in the marketing of grapes. The unit of sale varies from one market to another and sometimes even in the same market. For common understanding it is necessary that a standard unit of sale should be adopted in all markets. The passing of the standard weights act (1939) by the Central Government makes uniform progress possible throughout the whole of India.

Research. In India the classification of the different varieties of grapes has not yet been done. And very little work has been done in evolving new strains and varieties of grapes for more profitable yield than the existing varieties. Nothing has so far been done on improving the keeping qualities of grapes. Improvements on the yield and qualities of grapes are desirable and introduction of desirable varieties can also be undertaken. Experiments on grafting and budding should be conducted in the different centres of grape cultivation. The problem of training and pruning also deserves every attention. Experiments on methods of manuring with suitable manures for increased return should be undertaken. Pests and diseases levy a heavy toll upon the crops and hence suitable remedial measures should be devised to combat pests and diseases. The supply of reliable fruit plants to the growers are of very great importance. There should be a system of registering approved nurseries from which genuine plants could be supplied to the people. Much work in this direction has been done in Punjab. No attention has so far been paid towards propaganda and advertisement of fruits and fruit products. Exhibition of attractive posters, distribution of pamphlets, use of the cinema and broadcasting are the methods which may be explored. The Government of Baluchistan has done much work

M. K.

Crop & Trade Reports.

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 30th May 1941 amounted to 269,262 bales of 490 lb. as againt an estimate of 503,500 bales of the total crop of 1940–41. The receipts in the corresponding period of the previous year were 274,728 bales. 260,248 bales mainly of pressed cotton were received at spinning mills and 22,457 bales were exported by sea while 87,553 bales were imported by sea mainly from Karachi and Bombay. (*Director of Agriculture, Madras*).

Mofussil News and Notes.

Tuni. An Agricultural Exhibition on a large scale was conducted at Annavaram from 7th to 12th May 1941, during the Kalyanam festival of God Sri Veera Venkata Satyanarayana Swami Varo. The important exhibits were various paddy strains of the Agricultural Research stations, Samalkota, Maruteru and Anakapalle, samples of honey, bee colonies and bee-keeping equipment from Pithapuram, samples of Malt received from Govt. Agricultural Chemist, Coimbatore, fruits of pine apple, papaya and Sapota and bananas. Entomological and Mycological posters and charts also were exhibited, in addition to various improved and labour saving implements, pruning sets, sprayers and spraying materials. The exhibition was well attended to by many Agriculturists of the neighbourhood, and they evinced keen interest in the various articles that were on show. D. H. R.

College and Estate News.

Students' Corner. The College re-opened on the 16th June after the summer vacation and the second and third year students joined their classes.

Association of Economic Biologists. Prof. Mclean of Wilson College, Bombay delivered a lecture on the study and teaching of statistics on the 16th instant. Mr. M. C. Cherian presided.

Personal. We offer our congratulations to Sri. C. Ramaswami Naidu, Junior Lecturer in Agriculture on his appointment as Provincial Marketing Officer vice Sri. Rao Bahadur K. Gopalakrishnaraju on leave.

Officers' Club. The members of the Officers' Club entertained Dr. J. D. David, Lecturer in Animal Hygiene and Sri. M. V. Anganna Naidu, Teacher, Labour School, at dinner on the 16th instant. The former is posted to Kotagiri and the latter is leaving us for qualifying himself for the L. T.

Visitors. Mr. R. W. Littlewood, Livestock Development Officer visited the College Dairy for the inspection of dairy cattle.

Association of the Upper Subordinates. The Secretary of the Association of Upper Subordinate Officers of the Madras Agricultural Department writes: "The Annual General Body Meeting of the Association of the Upper Subordinate Officers will be held during the "College Day Week" in July 1941. All members of the Association are invited to be present at the function".

Weather Review—MAY 1941.

RAINFALL DATA

Division	Station.	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·3	−1·7	1·1
	Calingapatam	1·1	−1·5	1·5
	Vizagapatam	3·2	+1·2	5·9
	Anakapalli*	4·4	+1·8	7·3
	Samalkota*			
	Maruteru*	0·3	−2·0	0·5
	Cocanada	2·2	+0·7	3·9
	Masulipatam	0·4	−0·9	0·5
	Guntur*	1·4	−0·6	1·5
Ceded Dists.	Kurnool	0·5	−0·6	0·8
	Nandyal*	0·5	−1·2	1·5
	Hagari*	1·5	−0·7	2·5
	Siruguppa*	1·0	−0·7	3·6
	Bellary	4·0	+2·0	5·9
	Anantapur	0·9	−1·2	1·7
	Rentachintala	0·8		1·3
	Cuddapah	1·4	−0·2	3·1
	Anantharajupet*	0·0	0·0	0·0
Carnatic	Nellore	0·0	−0·8	0·2
	Madras	0·0	−1·1	0·9
	Palur*	0·0	0·0	0·0
	Tindivanam*	0·1	−1·5	1·6
	Cuddalore	1·1	+0·4	6·5
Central	Vellore	3·0	+0·7	3·5
	Gudiyattam*	2·5	−0·3	3·1
	Salem	5·7	+1·0	8·3
	Coimbatore	2·6	+0·2	5·7
	Coimbatore A. C. & R. I.*	3·2	+0·6	6·3
	Trichinopoly	2·0	−0·9	3·5

Division	Station	Actual for month	Departure from normal @	Total since 1st Janaruy
South	Negapatam	0·0	−1·6	4·7
	Aduthurai*	1·1	−1·0	5·2
	Madura	0·8	−2·1	9·9
	Pamban	0·7	−0·1	8·6
	Koilpatti*	1·7	−0·3	5·5
	Palamkottah	0·9	−0·7	7·2
West Coast	Trivandrum	17·3	+8·8	23·1
	Cochin	17·2	+5·5	22·1
	Calicut	24·6	+16·1	27·8
	Pattambi*	26·6	+18·8	28·2
	Taliparamba*	7·6	−1·1	11·0
	Kasargode*	5·2	−2·2	6·9
	Nileshwar*	7·5	−2·0	10·3
	Mangalore	4·3	−1·9	4·4
Mysore and Coorg	Chitaldrug	1·4	−1·7	2·4
	Bangalore	3·5	−0·9	6·9
	Mysore	6·6	+1·4	11·9
	Mercara	7·2	+1·5	10·4
Hills	Kodaikanal	3·8	−2·2	11·3
	Coonoor			
	Ootacamund*	7·1	+5·0	10·4
	Nanjanad*	—	—	—

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated up to 1937 (published in Fort St. George Gazette).

Weather Review for May 1941.

The weather over the peninsula during the first fortnight of the month was characterised by the usual hot weather conditions with high day temperatures and scattered thunderstorms due to convectional currents. The intense hot weather conditions that prevailed at the end of April tended to gradually merge into those favourable for an advance of the monsoon and with falling day temperatures.

On the 15th of the month conditions were unsettled to the west of Ceylon and continued till the 19th when the unsettled conditions either became unimportant or moved away to the north west.

On the 20th a temporary advance of the monsoon took place in the south of Bay of Bengal and a depression appeared in the Andaman sea by the 22nd,

on which date an advance of the monsoon occurred in the south east Arabian sea off Malabar and Ceylon. The monsoon appeared off Malabar on the next day accompanied by heavy rains, and also appeared in the south of the Bay of Bengal, when the depression intensified into a storm off Diamond Island. By the 24th the monsoon extended feebly into Konkan but the Bay storm weakened into a depression.

On the 25th a depression developed off the Malabar Konkan Coast and intensifying into a cyclonic storm crossed the coast on the 26th night near Calicut and by the next day had become unimportant. The Bay depression crossed the Bengal coast after weakening on the 26th. The combined effects of the depression off the Malabar coast and in the Bay of Bengal. occasioned heavy rains on the Malabar coast and adjoining regions from the 23rd till the 27th. Unsettled conditions in the west central Bay concentrated into a depression off the South Circars coast on the 31st of the month.

Rainfall was general over the presidency and in large excess in the West Coast and locally in the Hills and in slight excess in the Central districts, Circars and locally in the Deccan districts.

Temperatures were generally above normal at the beginning of the month but were about normal for the rest of the month. The highest day temperatures were recorded at Rentichintala (Guntur Palnad taluq) of 115° on the 1st and 113° on the 28th.

Chief falls of Rain reported in 24 hours were:

Pattambi	12 87"	27th.
Munnar (Travancore)	8·1"	"
Cochin	6·7"	23rd.
Angamali (Travancore)	6·3"	27th.
Calicut	5·7"	"
Quilon	5·7"	"
Calicut	4·9"	23rd.
Ootacamund	3·5"	27th.

Weather Report for the Agricultural College and Research Institute Observatory.

Report No. 5/41.

Absolute maximum in shade	...	101·4°F
Absolute minimum in shade	...	70·0°F
Mean maximum in shade	...	95·3°F
Departure from normal	...	+0 3°F
Mean minimum in shade	...	75·6°F
Departure from normal	...	+1·6°F
Total rainfall for the month	...	3·15"
Departure from normal	...	+0·55"
Heaviest fall in 24 hours	...	1 67" on the 27th
Total number of rainy days	...	3
Mean daily wind velocity	...	1·87 m. p. h.
Departure from normal	...	-1·80 m. p. h.
Mean humidity at 8 hours	...	67·6%
Departure from normal	...	-2·6%

Summary. Intense hot weather conditions prevailed during the first three weeks with a few thundershowers. The passage of the depression near Calicut on the 26—27th gave a heavy fall of 1·67". Maximum and minimum temperatures were in slight excess during the month.

P. V. R. & S. V. K.

Departmental Notifications.

Gazetted Services.

1. Appointments.

Sri C. Ramaswami Nayudu, Junior Lecturer in Agriculture and Assistant Superintendent, Central Farm, Coimbatore is, on return from leave, appointed to officiate as Provincial Marketing Officer, Madras in Category 3, class I, Madras Agricultural Service, Vice Sri Rao Bahadur K. Gopalakrishna Raju, granted leave.

Sri C. R. Srinivasa Ayyangar, who is the seniormost Crop Specialist, is appointed as Paddy Specialist and Geneticist, Coimbatore, during the absence on leave of Sri Rao Bahadur G. N. Rangaswami Ayyangar.

Sri C. Vijayaraghavan, Permanent Upper Subordinate, Research Section and officiating Gazetted Assistant to Principal, Agricultural College, Coimbatore, is appointed to officiate as Millet Specialist, Coimbatore Vice Sri Rao Bahadur G. N. Rangaswami Ayyangar, granted leave.

Sri K. Raghavacharya, District Agricultural Officer, Madura, is appointed to officiate as Junior Lecturer in Agriculture and Assistant Superintendent, Central Farm, Coimbatore, *Vice* Sri C. Ramaswami Nayudu on other duty.

Subordinate Services.

2. Transfers.

Name of officers.	From	To
Sri N. G. Narayana,	Asst. in Cotton, Mungari Cotton Station, Adoni,	Asst. in Cotton, Coimbatore.
„ S. M. Kalyanarama Ayyar,	Asst. in Cotton, Coimbatore,	Asst. in Cotton, Adoni.
„ K. Satyanarayana-murthy,	Asst. in Cotton, Adoni,	Asst. in Cotton, Nandyal.
„ K. Sanjiva Shetty,	Teaching Asst. in Agri., Coimbatore,	A. D., S. Kanara Dt.
„ K. S. Ramanna Rai,	A. D., Udipi,	A. D., Kudligi.
„ S. Krishnamurthi,	D. F. S., Hagari,	F. R. S., Kodur.
„ P. N. Krishnaswami Rao,	Asst. in Cotton, Nadam Cotton Scheme,	Asst. in Cotton, Coimbatore.
„ M. Vaidyanathan,	A. D. (on leave),	A. D., Hadagalli.
„ M. G. Krishnaswami Sarma,	A. D., Sattur,	F. M. A. R. S., Palur.
„ D. S. Subrahmanya Ayyar,	A. D., Periakulam.	A. D., Devakottai.
„ S. Ramaswami Ayyar,	Asst. in Botany, S. B. S., Gudiyattam,	F. M., Central Farm, Coimbatore.
„ P. Krishnaswamy,	Asst. in Millets, D. F. S., Hagari,	Millets Asstt., Coimbatore.

Leave.

Name of officers.	Period of leave.
Sri N. Subramania Ayyar, A. D., Ambasamudram,	L. a. p. for 1 month from 30—5—'41.
,, V. Buchiraju, A. D., Chintalapudi,	L. a. p. on m. c. for 3 months from 14—5—'41.
,, M. A. Balakrishna Ayyar, A. D., Wallajah,	L. a. p. for 1 month from 4—6—'41,
,, K. K. Subramania Ayyar, A. D., Devakottai,	L. a. p. for 2 months from the date of relief.
,, M. J. David, Asst. in Soil Physics, Hagari,	L. a. p. for 4 months from 10—6—'41,
,, V. Ratnaji Rao, A D., Sullurpet,	L a. p. for 1 month and 14 days from 20—7—'41.
,, N. Krishna Menon, Sub-Asst. in Entomology, Coimbatore,	L. a. p. for 2 months from 16—6—'41.
,, K. Sitarama Ayyar, A. R. S., Pattukottai.	Extension of l. a. p. for 2 months from 23—5—'41

CO-OPERATION BETWEEN AGRICULTURAL AND REVENUE DEPARTMENTS

[*We publish below the text of a Government order on Co-operation between the Agricultural department and Collectors of districts. Ed. M. A. J.*]

G. O. No. 745, Development, dated 16th April 1941.

The following suggestions were made at the Collectors' Conference held on 24th January 1941 in connexion with the discussions on the subject of co-operation between the Agricultural department and the Collectors:—

(1) That an Assistant Director of Agriculture should be appointed for each district to enable that officer to be in close contact with the Collector;

(2) that a committee should be appointed in each taluk consisting of the tahsildar, the minor irrigation overseer and the agricultural demonstrator to report to the Collector on the extent of damage, etc., caused by soil erosion;

(3) that each Collector should be provided with a discretionary grant of Rs. 500 each year to be spent on the award of prizes and rewards to non-officials in recognition of the help rendered by them to the Agricultural department in its propaganda work;

(4) that village officers should maintain separate statistics relating to areas under improved strains of crops such as Co. 2 cotton and paddy strains;

(5) that tahsildars and village officers should be required to render to the agricultural demonstrators the necessary assistance in their dealings with the ryots;

(6) that the tahsildars and the revenue inspectors concerned should be supplied with information regarding the work on improved strains, etc., that is being done in each taluk;

(7) that the Collectors should encourage Assistant Directors of Agriculture to meet them more freely and discuss agricultural matters; and

(8) that the officers of the Revenue and Agricultural departments should bring to the notice of the ryots the evil effects of soil erosion.

2. His Excellency the Governor has considered these suggestions and is pleased to issue the following orders:—

(i) *Suggestion* (1).—The Government have decided that each district should have an Assistant Director of Agriculture to be designated District Agricultural Officer. Orders in that regard have been issued separately.

(ii) *Suggestions* (2) to (5).—These are under the consideration of the Government separately.

(iii) *Suggestion* (6).—This suggestion is accepted. The Director of Agriculture is requested to see—

(*a*) that the registers of the agricultural demonstrators, giving an account of the work already done, that in progress and that chalked out for the future, are sent to the tahsildars concerned for perusal at fixed intervals;

(*b*) that agricultural demonstrators meet the tahsildars concerned at least once a month and keep them informed of the works of agricultural improvement undertaken by them in the taluk; and

(c) that agricultural demonstrators communicate copies of their tour programmes to the tahsildars and the revenue inspectors concerned.

(iv) *Suggestion* (7).—As the orders referred to in item (1) above make the Collector and the District Agricultural Officer responsible for the agricultural programme of each district, the District Agricultural Officer will necessarily have to meet the Collector more frequently than has been customary in the past. No further action on the part of the Government is therefore necessary with reference to this suggestion.

(v) *Suggestion* (8).—In an article published in the Villagers' Guide and Calendar for 1941, attention has been specially drawn to the dangers of soil erosion and suggestions have been made as to the preventive measures to be adopted. The Government have also ordered in G. O. Ms. No. 2191, Development, dated 14th September 1940, that very active efforts should be made by the Agricultural department with the co-operation of the Revenue department to bring home to the ryots the loss which the latter are sustaining by soil erosion and to induce them to put far more labour than they have been accustomed to do in the past into embankments and revetments and, where it is practicable, in terracing in order to minimize erosion. To bring home the dangers of soil erosion to the rural population, the Director of Agriculture is requested to broadcast occasionally a talk on the subject and the measures to be adopted to prevent it.

The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

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THE THIRTIETH COLLEGE DAY AND AGRICULTURAL CONFERENCE, 1941.

The thirtieth College Day and Agricultural Conference organized by the Madras Agricultural Students' Union, Coimbatore, was held between 10th and 13th July. Inspite of the economies that have to be enforced during the period of war, it is a matter of great satisfaction to us to note, that the Union found it possible to celebrate, this year also, quite successfully the College Day and the Conference. But for the wonted kindness of the Director of Agriculture, this would not have become an accomplished fact. The Director of Agriculture not only expressed great regret at the absence of the bulk of those who had contributed papers which made the discussions on these papers very weak, but went even so far as to say that in future he would depute all those who contributed papers for this conference which is indeed very gracious on his part. We expect therefore the future conferences to be very lively and thought-provoking.

The Madras Agricultural Students' Union was lucky in getting Dr. C. R. Reddy, the Vice-chancellor of the Andhra University, to preside over the College Day and Conference. At 12 noon on Thursday the 10th July, Dr. C. R. Reddy the president-elect was received at the entrance to the conference hall by Messrs P. H. Rama Reddy, the Director of Agriculture, Madras, R. C. Broadfoot, President of the Union and C. R. Srinivasa Ayyangar, Vice-President.

Mr. R. C. Broadfoot, welcomed the large and enlightened gathering with a welcome speech. The Secretary then read several messages received from the patrons, members, friends and well wishers of the Union who regretted their inability to be present but accorded their best wishes to the success of the conference. The Annual Report of the Union was then read by the secretary.

The chairman then delivered his presidential address (reproduced elsewhere) which was as inspiring as it was learned and was listened to by the gathering with rapt attention. He complimented the Coimbatore Agricultural College on the high standard of training given, and said that its researches had become world famous. It was really unfortunate Dr. C. R. Reddy was not keeping good health and as such, soon after he concluded

his presidential address, he had to leave the conference. Mr. P. H. Rama Reddy, the Director of Agriculture, took his place and conducted the rest of the proceedings. This year the papers read formed a Symposium on Fruit Culture in South India and they were ten in all. Interesting discussions followed as usual and the only feature to be regretted was the authors of the papers in many cases were absent.

The chairman of the Conference Dr. C. R. Reddy gave away the prizes and medals won by the students of the college during the academic year 1940—41 and the Ramasastrulu—Munagala prize to Sri. A. Sankaram, B. Sc. (Ag.), at the end of which he humourously remarked, "usually a lady is chosen for giving away the prizes. I do not know why I have been asked to do this".

On the 11th, the second session of the Conference was held from 9 A. M. to 12 noon, when the second batch of five papers were read. The president wound up the proceedings by a summing up of the papers and the discussions which followed, and expressed sorrow at the absence of the authors of the papers, and ended by appealing to the members of his staff in the department to make strenuous efforts to help the cause of the ryot.

Mr. C. R. Srinivasa Ayyangar, the Vice-President of the Union, proposed a vote of thanks to Mr. Rama Reddy for having kindly presided over the function in the unavoidable and very much regretted absence of Dr. C. R. Reddy. He also thanked the several members of the Union and friends who contributed to make the conference and other functions a success.

On the 10th night the members of the Union entertained the visitors, when short pieces in English, Telugu and Tamil were staged. A noteworthy feature connected with the entertainment of this year is that the best actor in each play was awarded a medal.

Saturday, the 12th July witnessed the College Athletic Sports. The members of the Union and other guests from the town were entertained while the sports was going on, with fine music by means of a radio with loudspeakers connected to it. The Union was "At home" to the large gathering of members and guests who had congregated to witness the contests. At the end of the sports Mrs. Imamuddin kindly gave away the trophies and prizes to the successful competitors. On the 13th morning the members of the Union met in the Freeman Hall where the Union was "At home" to its members. After *chota hazri* they adjourned to the conference hall where the annual general body meeting of the Union was held under the chairmanship of Mr. R. C. Broadfoot, President of the Union. The annual report and statement of accounts were adopted and the office bearers for the year 1941—42 were elected.

The afternoon was spent in visits to the Research Institute, Central Farm and Crop Breeding Stations where the visitors were shown round the work in progress and the results achieved in the immediate past. There was also a friendly cricket match between the Old Boys and the Rest.

Welcome Address.

(By R. C. Broadfoot, Principal and President of the M. A. S. Union).

Mr. President, Ladies and Gentlemen,

Once again it is my privilege to extend to all present, the Madras Agricultural Students' Union's welcome to this the 30th College Day and Conference—a function organized by the Union to revive college associations among its members.

To you, Sir, I would express the Union's grateful thanks for accepting its invitation to preside on this occasion. As Vice-Chancellor of the Andhra University you are known for your high literary attainments, as a member of the Legislature for your robust political experience and views, and now as President of this gathering for your interest in agriculture—a worthy addition to your other attainments. We regret your engagements curtail the duration of your present visit, but we hope that some day in the near future you will return and view the Agricultural College and Research Institute in its working garb. I can assure you there is much of interest to show the scientifically trained visitor.

We are pleased to welcome also Mr. P. H. Rama Reddy, Director of Agriculture, whose interest in the Union extends over two decades. We regret the recent retirement of two of our most active members, Messrs. K. T. Alwa and K. Unnikrishna Menon. We wish them peace and joy in retirement and hope they will continue their valuable assistance to the Union.

Once again we meet under the heavy shadow of the war cloud—a cloud which has grown bigger and more ominous within recent months. In the face of war it is difficult to talk of peace, but we hope the day is not far distant when peace of a lasting type will replace the present unsettled state of the World and will permit people to pursue their peaceful vocations.

To-day's symposium deals with fruit culture in the Madras Presidency—a branch of horticulture which has only recently received scientific attention. It is hoped that all who can, will take part in the discussions on the paper read and by so doing add to our knowledge of the subject. As usual visitors will be shown round the respective Research Sections, Breeding Stations, and Central Farm. Previous advice to the Heads of the Sections concerned is desirable in order that arrangements can be made for a suitable guide or demonstrator.

Last year's examination results while not up to the previous years, were not unsatisfactory, and 41 candidates have qualified for the degree and now seek suitable employments. Their future prospects are a matter of some concern to this College as they are likely to affect future applications for admission. There has been a considerable drop in the number of applications for admission to the current session and the class is not yet up to its full strength. Prizes will be presented to the prize-winners of 1940-41 session at the close of the Presidential Address and I wish to congratulate all winners on their successes resulting from hard and diligent work. I would here remind all graduates that there are still prizes to be won in all careers, and hard work and diligence are factors which will always contribute to success.

I have little more to add except to require that students leaving the College keep in touch with the Union and by becoming members, help to expand the work which has been so well done during its 30 years' existence.

Besides welcoming you on behalf of the Union I express the pleasure it gives me to welcome you all on this occasion.

Messages.

Messages wishing the College Day and Conference success were received from the following:—H. M. Hood, Adviser to H. E. the Governor of Madras; Dr. Gilbert Fowler, Madras; Dewan Bahadur D. Ananda Rao, Madras; Principal Alexander Gnanamuthu, Tinnevelly; Rai Bahadur Nallathambi Sarkarai Manradiyar, Pattagar of Palayakottai; ; Rao Bahadur B. Viswanath, New Delhi; Rao Bahadur K. T. Alwa, Mangalore; Rao Sahib M. Ananta Narayana Rao, Madras; Mr. Nizamuddeen Hyder, Hyderabad; Mr. A. K. Menon, Calicut; Rao Bahadur M. R. Ramaswami Sivan, Anand; Mr. P. V. Hanumantha Rao, Panyam; Mr. Ghulam Dastagir Sahib Bahadur, Coimbatore; Mr. Sitarama Patrudu, Samalkot; Director of Agriculture, Poona; and Messrs R. G. Nallkuttalam Pillai, Srivilliputhur; K. R. Sanker, Pudukotah, and G. Satyanarayana, Ramachandrapuram.

Report of the Managing Committee for the Year 1940—41.

(Presented before the open session, July 10, 1941)

Mr. President, Ladies and Gentlemen,

The Managing Committee of the Madras Agricultural Students' Union have great pleasure in presenting their report for the year 1940—41.

The War. The period under report has been none too bright for us. The European war that commenced in 1939 has developed into a world war. Hitler and his associates by threat, by force or by both, have not only annihilated many independent states in Europe, but have extended their menace to Atlantic in the West and Asia in the East. The enemy is almost at our door and it is only an all-out effort that can save us from the most ruthless brutality in history.

Effect of War on Agriculture. The European war has surely rebounded on the agricultural economy of India as of other countries. Under the stress of war conditions all industries are bound to suffer except those concerned with war. Due to want of shipping space, exportable commodities have received a serious set back. With the closure of the continental markets for groundnut, the most important money crop next to cotton for the poor ryot in precarious tracts, the export trade in this commodity suffered and created a situation unprecedented in the annals of the industry. Faced with the prospect of a large surplus and the consequent slump in prices to uneconomic levels, it was thought prudent to restrict the area of cultivation. Apart from this proposal, Government is bestowing its attention on storage of surplus by some agency, increased internal consumption and alternative uses for nut and oil. Increased crushing of the oil seed in our own country and utilising the oil and oilcake is an urgent problem. Oil could be utilised for various industrial products now being imported from outside such as vegetable ghee, lubricating oils, etc. The cake is a valuable and cheap organic nitrogenous manure well recognised in S. India as manure for such crops as Paddy and Sugarcane. As a cattle feed groundnut-cake is excellent for our impoverished work and milk stock as well. Intensive propaganda on all these aspects of utilising the produce in the country is now being done. Other agricultural products that suffer from surplus stocks are sugar, coffee and jute. The Coffee Market Ordinance passed recently with provisions for the control of production and pooling of surplus, may relieve the situation.

Madras Debt Relief Act Upheld: The Madras Debt Relief Act whose validity was questioned before the Federal Court in the form of an appeal, was upheld by

the learned Judges much to the relief of the small agricultu: sts of the province who are suffering from chronic indebtedness.

Imperial Council of Agricultural Research: It is a matter for great satisfaction that the finances of the Imperial Council of Agricultural Research have been placed on a sure foundation by the imposition of a cess on exported agricultural produce which in future will finance the Council. This is believed to relieve the anxiety of the council regarding its finance, and with better stability it will be able to function in a wider and better sphere to the great benefit of the provinces than hitherto. We are glad that the research schemes in oil seeds and animal nutrition in our province have been extended.

Report of the Committee on Co-operation:—The report of the Vijayaraghavachari Committee has been issued during the year. It is compendious and comprehensive and its recommendations are far reaching. It tackles the agricultural marketing aspect and one of its recommendations is to transfer the marketing section from the Agricultural Department to the Co-operative. In this connection we beg to point out that agricultural production and marketing go together. Agricultural officers who are well versed with production and produce will be able to function better in marketing than others. This is in conformity with the suggestion of the Agricultural Marketing Adviser to the Government of India not to circumscribe the activities of the marketing section within the limited sphere of the Co-operative Department.

Reorganization of the Agricultural Department. It is a matter of great satisfaction that the Government have sanctioned one District Agricultural Officer for each district for efficient guidance and control of the propaganda. But it is regrettable that this development was carried out by retrenching some posts of Deputy Directors and Demonstrators. We hope ere long all the retrenched posts will be restored.

Co-ordination between the Activities of the Revenue and Agricultural Departments. The proposal for co-ordination between the several departments concerned with the ryots has been before the Government of Madras for a long time and we are glad that orders have been issued recently indicating the lines of co-operation between the Revenue and the Agricultural Officers. We hope the order will be implemented by both the departments in a true spirit of co-operation to the ultimate benefit of the agriculturists of this province.

Refresher Course for Propaganda Officers. The Government of Madras have accepted the proposal of the Director of Agriculture for holding a refresher course for Agricultural Demonstrators lasting for a month at the Agricultural College and Research Institute, Coimbatore. Several improvements in scientific agriculture are developing from time to time and the propaganda officers in the districts have little chance to get acquainted with these. The refresher course with a well arranged and comprehensive programme will no doubt keep them abreast of the times.

Fruits. The Punjab with only about 62,008 acres under fruit has a well established fruit section attached to the Agricultural Department, while Madras with 420,000 acres (nearly seven times that of the Punjab) has commenced its work on fruits only in 1935. In both quality and quantity there is much lee way to be made in fruit production and we hope this conference which is going to discuss the subject of "Fruit Culture" in a symposium will give the lead and draw the attention of the public and the Government to this important problem.

College Day and Conference 1940. The celebration of the College Day and he organisation of an Agricultural Conference is one of the main activities of

the Union. The Twenty-ninth College Day and Conference was celebrated last year from the 13th to 17th July. Mr. S. V. Ramamurthi, M. A., I. C. S., then Member of the Board of Revenue, Madras, presided over the Conference. A symposium on soil erosion was organised for the conference, in which many prominent workers in the field, official and non-official, participated. Besides contributions from the departmental officers, contributions were also received from the representatives of the Forest Department, Co-operative Department and the S. Indian Tea and Coffee industries. Papers covering a wide range of agricultural subjects were presented for the second session of the conference. Though devoid of the usual side-shows associated with the conference, such as an agricultural exhibition and a Departmental Conference of Gazetted Officers, the conference concluded very successfully. Details of the conference proceedings have appeared in the 1940 July number of the Madras Agricultural Journal.

The Madras Agricultural Journal. Besides celebrating the College Day and conducting the Agricultural Conference, the all-the-year round activity of the Union is the publication of the Madras Agricultural Journal. We are glad to record that the Journal continued to maintain the high standard associated with it.

We are also proud to note that research workers in departments and institutions outside our presidency have come to feel that our journal has a place among the scientific journals of the world and are seeking its aid for the publications of the results of research. It has on its exchange list a wide range of publications from several foreign countries both in the East and West. The importance of the journal can be easily realised when we say that the Department of Agriculture, California, requested our journals to be reserved for them till the times return to normal, lest they should be lost in transit.

Our New Patrons. Sri Rao Bahadur K. T. Alwa, retired Headquarters Deputy Director of Agriculture, who has been a member of the Union since its inception, has graciously become a patron of our Union during the year. We take this opportunity to convey to him our grate-fulness for this tangible proof of his interest in the welfare of the Union.

Honours. We are glad to note that Sir C. P. Ramaswami Ayyar, Dewan of Tranvancore and a patron of the Madras Agricultural Students' Union was awarded the K. C. S. I. and that the title of Rao Bahadur was conferred on Sri. K. T. Alwa, before his retirement as Head-quarters Deputy Director of Agriculture. We offer our congratulations to these gentlemen on their well merited distinctions.

Our Members. It gives us great pleasure to know that the Andhra University has conferred the honorary degree of Doctor of Science on Rao Bahadur T. S. Venkataraman, C. I. E., Sugarcane expert and a member of the Union, in recognition of his epoch making researches in Sugarcane. We offer our congratulations to the Doctor on his well merited honour. We are glad to learn that Rao Bahadur M. R. Ramaswami Sivan, retired Principal of the Agricultural College, Coimbatore, was appointed as the Director of the Agricultural Institute, Anand (Gujarat). It is a fitting choice and we offer our felicitations to the Rao Bahadur and wish him a long and useful career at Anand. Dr. T. V. Ramakrishna Ayyar, retired Government Entomologist, Coimbatore, has been appointed Entomologist, Hyderabad State. We hope that Dr. Ayyar with his long and versatile experience in the Madras Agricultural Department will be an asset to the State. We wish him all success in his new sphere of activity. Mr. M. B. V. Narasinga Rao, Assistant in the Paddy Section has been appointed as Temporary Assistant for a period of 18 months under the Imperial Council of

Agricultural Research in connection with the scheme for the preparation of a monograph on "Rice breeding and genetics in India". Mr. P. Abraham, Assistant in the Cotton Section, has been permitted to enter foreign service as Scientific Officer to Bombay-Burma Plantations Ltd. We are also glad to know that C. Jagannatha Rao, Gazetted Assistant, Mungari Cotton Scheme, has been selected for appointment as Agricultural Officer in Coorg. We offer these gentlemen our congratulations.

Agricultural Graduates. It is with deep concern we view the increasing number of the unemployed graduates of the Agricultural College. Inspite of the reorganisation more posts could not be created for absorption. The graduates are not wanted by other departments of the Government even though they are eminently fit for many services in the Revenue, Co-operative, Registration, Panchayat and Education Departments. We hope the Director of Agriculture will press their case.

Retirement. Since our last report Sri. Rao Bahadur K. T. Alwa, Headquarters Deputy Director of Ariculture retired from service. He was one of the founder members of the Madras Agricultural Students' Union inaugurated in 1911, and has ever been a devoted member. Besides being a joint Secretary in the first year of its inception, he held office in the Union as executive committee member, Sub-Editor of the Journal and moffusil Vice-President. We are grateful to Rao Bahadur K. T. Alwa for perpetuating his connection with the union by becoming one of its Patrons. Mr. K. Unnikrishna Menon, Deputy Director of Agriculture and Senior Lecturer in Agriculture and Superintendent, Central Farm, has proceeded on leave preparatory to retirement from service. He was also associated with the Union for a long time. He was resident Vice-President, Moffusil Vice-President and also the Sub-Editor of the Journal. We wish them both long and peaceful life.

Obituary. We record with regret the passing away of Sri. M. Sambanda Mudaliar, B. A., B. L., Advocate, Coimbatore and a Patron of the Madras Agricul-cultural Students' Union. Sri. T. V. Narayana Rao, Retired Farm Office Manager, passed away during the year at the ripe age of seventy-one. Sri. T. A. Rangaswami Iyyengar, K. Rajabapanniah, P. Parthasarathy and V. Panduranga Rao, all members of the Union, prematurely passed away during the year. We take this opportunity to convey our condolences to the members of the bereaved families.

Acknowledgements. It is now our pleasant duty to record our thanks to all those who have helped the Union during the year. To Sri. S. V. Ramamurthi, M. A., I. C. S., the Union owes a deep debt of gratitude for presiding over the College Day and Conference last year. To the various contributors of papers who participated in the symposium on soil erosion last year, we tender our sincere thanks. To Mrs. K. M. Unnithan, who distributed the prizes for the sports, we record our grateful thanks. To Mr. Westlake, I. C. S., the then Director of Agriculture. who took keen interest in the affairs of the Union, for the invaluable help rendered in arranging for the conference last year and for the special interest he took in the Madras Agricultural Journal, the committee tender their heartfelt thanks. We are also very grateful to Mr. P. H. Rama Reddy, our present Director of Agriculture, for his continued interest in the affairs of the Union. To Mr. R. C. Broadfoot who, as president, has always actively helped the Union in its various activities we tender our grateful thanks. Our grateful thanks are also due to all other ladies and gentlemen who in various capacities have helped the Union in the celebration of the College Day and Conference last year as well as in its day to day activities during the year.

Presidential Address

By Dr. C. R. REDDY, M. A., (Cantab), D. Litt., M. L. C.,

Vice-Chancellor, Andhra University, Waltair.

Ladies and Gentlemen,

It gives me no small amount of pleasure to have accepted the invitation of the Madras Agricultural Students' Union and to be present here to preside over the College Day and Conference this afternoon. Let me first congratulate the Agricultural College which has been functioning so well and has become world famous by its researches. I have to congratulate in special Mr. T. S. Venkataraman who by his experiments has been able to make the world sweeter by lowering the cost of production of sugarcane many times below what it used to be 25 years ago. I am glad that all of you in the college have approved the action of the Andhra University in having passed a resolution to confer the highest honorary degree in science on Mr. Venkataraman. The Andhra University had from the beginning followed the principle and policy of recognising Indian merit. I feel that it is a duty cast on our universities to recognise wherever it is, knowing that we have not so far suffered from over-generosity in the conferment of degrees. If we do not honour our own men who else would ?

Mr. S. V. Ramamurthi, Chief Secretary to Government, who presided over the College Day and Conference last year gave a very learned discourse on problems relating to agriculture which was full of mathematical ratios. I, for my part wish to view from the layman's point the subject of agriculture in the economy of India. I agree with Mr. Ramamurthi in thinking that agro-industry should solve the problem of poverty in our country. Our country is terribly poor. Most of the people do not live, they simply exist. Philosophers used to tell that we are creatures between life and death, but the fact is we are nearer death. There are two things which I wish to suggest as a remedy. The first is an economico-political situation namely the establishment of colonies. European nations under pressure of population expanded over Canada, the Western Hemisphere, Australia, Africa and other countries. This resource is not open to Indians for various reasons. Of course our people have gone to Burma, Ceylon, South Africa and Guiana, but not as colonists in the full sense of the term. At best they are labourers, not even settlers. They do not enjoy the rights of the colonists or the right to hold real property. Restrictions are placed on their right to trade, to dwell in municipalities and on their freedom, economic and civic. After the great war hopes were held out that, in recognition of the part played by India in support of the allies, they would be allowed not a monopoly but at any rate an unfettered right to migrate on terms of full citizenship to places in Africa, like Kenya. You know what happened. The cool heights and plains of Kenya were reserved for Europeans and Indians were excluded there from. It strikes me that while we declaim the horrid bitter racialism for which Nazi Germany stands, it cannot by any means be

said that racialism is altogether absent from the other dominating peoples of the world. I would like to see the British Commonwealth of Nations a real Commonwealth with no white Australian Policy or white South African Policy to vitiate the conception of equal rights and equal sacrifices which must always go together. But I know as a student of history these ethical reforms instilling human equality and human oneness cannot be achieved for the asking or realised. We must have patience. As things are, we have not been able to secure a satisfactory solution of the Indian problem in Burma and in Ceylon. We, Hindus, cannot afford to throw stones while we ourselves have lived in glass houses for generations. Inspite of the Vedantic doctrine that all souls are equal and that they have emanated from one God inequality is there, invidious and deplorable, and not merely accidental but the essence of our social order. We should set an example of the equality which we ask for, and recognise that it would require time and moral evolution to bring about the desired result.

The second remedy I wish to put forth before you is intensive cultivation. Before I deal with it, I wish to refer to the proposition once advanced that India should remain a raw material producing country and need not get industrialised. Mr. J. M. Keynes, the distinguished economist, held that all raw material producing concerns worked under the law of diminishing returns. Arguing so, Mr. Keynes was of opinion that India being an agricultural country, the value of her products would go up, that it would ultimately benefit India were she to remain a raw material producing country and allow European countries to manufacture goods, maintaining thus a division of labour between Europe and India. But like most economists he assumed several conditions, such as, peace in the world, free trade and free exchange. But you know that none of these conditions are fulfilled. It is now clear that peace with European nations meant a period of preparation for war. The situation today belies the theory of the economists. The idea that we could export our raw surplus has to be abandoned. The value of the produce which depends on the foreign market has fallen. Further more, there are no ships to export. And if there are ships to export there is no guarantee that they would reach the other end. Government are trying to regulate the supplies. The other remedy is the development of manufactures. Had the Government the prudence to have done so before, we would be not only helping ourselves but also the Empire at this moment in a greater measure. This appears to work in a vicious circle. We could not get the machines or tools. At best these would be had only on a small scale. On the whole, it is sad to contemplate that the Government's policy had been in peace time no need, and in war time not possible.

Intensive agriculture is a thing with which the College has been closely associated from its inception. I am very glad to see the exceedingly good work that the College has been doing. It is not merely in sugar, but in respect of paddy, of groundnuts and in many other ways it has helped agriculture a great deal. A distinguished friend of mine felt rather

dis-appointed that the scientific methods of agriculture taught here were not so widely known as to be adopted by the ryots. I am not able to say who is responsible for this defect. If the Director of Agriculture could remedy this defect I am perfectly sure he would do so. But there are other factors. The ryots are too poor to adopt new methods even though these meant more profit to them. The initial expenditure stands in the way. And this defect is greater under the Hindu law, which led to fragmentation of holdings. In Japan, fragmentation was once prevalent to such an extent that bunds covered a good portion of the fields. But it was remedied by a law for consolidation. Some such remedy is needed in India. The Government and the people must move quickly. During war time there may be difficulties, but an attempt has to be made. Meanwhile there is an awakening and the silver lining of the war is seen in its effect in promoting industries and agricultural production. Government and people must work together and whole-heartedly to achieve the desired end.

I now come to the problem of unemployment among agricultural graduates, and let me urge that agricultural graduates should set an example in self-reliance. In America and Canada a system of rural education has been evolved which imbued the young men and women with a spirit of learning agricultural and domestic science. Perhaps, an adaptation of some such method, I believe, might be more expedient here than trying to produce all the teachers necessary for the elementary schools from an institution like this College. The primary function of the College should be to keep up its research work. Coimbatore is an ideal centre for starting paying industrial enterprises in co-ordination with agriculture.

Whatever be our quarrels, let us remember our tie with the British people for the past 250 years and during this period of war, it is our duty to support them. It is certainly better to build up on existing conditions than to invite a complete smash up with all its horrors. Even before the outbreak of the war, I had felt that the country was not in a fit condition for transference of power. Communalism had grown to such dimensions that it threatened the very integrity of India. There is a division and we could not come to an agreement even during the present moment. Our duty is very clear, especially after Hitler's invasion of Russia. It is impossible for any power to come to an agreement with Hitler as he would not keep his word if anything lay within his mailed fist. In the glare of that venomous animal all things nearby got frozened into inactivity, waiting to be devoured by him. We are not fortunately near it, nor are we so far away as to feel safe. Some think that the war is threatening India now, but the deeper view according to me is, the war is already over the entire world. India is already in it. I felt so even when the war broke out. The real purpose of Hitler is to establish a new order, and it has nothing to do with the Treaty of Versailles or anything of that kind. The central conception of his new order is that all the world should be under the domination of Nazi Germany and dependent on her.

For the first time, I shall reveal now one thing which I did in 1939. I wrote to the authorities that when they won the war, at least the Italian portion of Africa should be given over to India. War means always waste and it should speedily be replaced. Production should be therefore raised to the maximum. We could thus help Britain in the war so that the legitimate freedom of the people in the world and national rights might be established. We should help Britain to strike back with such force that Nazi Germany would not resist.

List of Prize Winners.

1. The Robertson Prize (the premier prize of the college, for Agriculture in the Final Examination)	V. R. Rajagopalan
2. The Clogstoun Prize (for general proficiency in the college terminal examination)	N. Srinivasulu.
3. The Kees Prize (for Agricultural Chemistry)	B. Narasimham.
4. The Sampson Memorial Prize (for Agricultural Botany)	G. Rama Rao.
5. The Dewan Bahadur R. Raghunatha Rao Prize (for Practical Agriculture, final examination)	P. Venkateswara Rao
6. The D'Silva Memorial Prize (for Animal Hygiene)	C. Sankara Rao.
7. The Goschen Prize (for Agricultural Zoology)	K. Rammohan Rao.
8. The Anstead Prize (for plot cultivation)	V. Mahimai Doss.
9. The Rao Bahadur K.S. Venkatarama Ayyar Prize (for best student in the first examination)	C. Krishnamurthi.
10. The L. D. Swamikannu Memorial Prize (for the highest total marks in all the three University examinations)	G. Rama Rao.
11. The Certificate Course Cup (for Agriculture in second examination)	A. Adivi Reddy.
12. The Old Cuddapah District Agricultural Association prize (best student from the Ceded Districts)	Mirza Anser Baig, I year. C. Sankara Rao, II year. N. Bhaskara Reddy, III year.
13. The Gupta Prize (for Agricultural Engineering)	K. Rammohan Rao.
14. The M. K. Nambiar Memorial Prize (for the highest total marks in the second examination)	A. Adivi Reddy and C. Sankara Rao.

Papers.

Symposium on Fruit Culture.

1. Some noteworthy features of fruit industry in the Rajampet Taluq—*T. K. Viswanathan.*
2. Culture of Kodur oranges—*M. Mohan Rao.*
3. Cropping behaviour in mangoes—*K. C. Naick & M. Mohan Rao.*
4. A few observations on polyembryonic mangoes in the West Coast—*E. K. G. Nambiar.*

5. Our present position with regard to the control of fruit pests — *M. C. Cherian,*
6. Fruit nursery practices—*V. Venkatadri Reddi and R. S. Sundaram.*
7. Nagari oranges, their past and present—*A. Muhamad Ali.*
8. Fruits as food—*Rao Sahib G. Jogi Raju.*
9. Some fruit diseases in relation to horticultural practices and mineral deficiencies—*D. Narayana Rao.*
10. Some promising fruit products of South India— *R. S. Sundaram and D. Krishnaswami Naidu.*

Chairman's Concluding Remarks.

Gentlemen,

I am sure you will all agree that we had a very successful conference. It is really unfortunate that Dr. C. R. Reddi could not stay for the entire proceedings. It is a great thing that inspite of his indifferent health he was able to go over here to give us his very valuable presidential address. The Madras Agricultural Students' Union has to be congratulated on the selection of a very important subject like Fruit Culture, which is of tremendous importance to the country. The fruit industry is not a new thing to us. It is one of the oldest in India, but unfortunately most of the orchards are in a neglected condition. The Government is alert to the situation and a Fruit Specialist is to be appointed in the very near future. What is more, Demonstrators are already being trained in Horticulture at the Fruit Research Station, Koduru, and they have to give the fruit growers all adequate help in promoting this industry. There is no danger of over-production of fruits in such a vast country as ours. In the past it might be, garden owners were getting very high income, and it is just possible due to increase of orchards income is going down; but I am sure the income will never reach an uneconomic level. From the consumers' point of view reduction of the price of fruits is certainly necessary, especially when we know that fruits are desirable for invalids, children and old people. Cold storage, which is an essential factor, has to be developed. In connection with insecticides which form an important feature of this industry, I am glad the Entomologist is carrying on research work on indigenous insecticides. For, you know we are importing a great deal, and it is always best we stand on our own legs. Before I finish, I appeal to the Departmental Officers to carry on the work of demonstration and propaganda in co-operation with the Revenue Department to the great benefit of the ryots of the Province. It is my wish that this work must be carried on with all the zeal and sincerity of a missionary.

College Day Entertainment.

The College Day entertainment which came off on the 10th instant was of the usual standard of excellence. The Students put on boards a piece in English, a small farce in Telugu and a romantic play in Tamil intercepted with comic interludes, in which Mr. C. S. Rajaratnam took a prominent part. The scenic arrangements were good and all the actors acquitted themselves very well

indeed; but special mention must be made of the contribution of Mr. T. Chellapa (English), Mr. C. Ramakanta Reddy (Telugu), and Mr. V. Mahimai Doss (Tamil). These three deservedly in our opinion won the medals instituted by the entertainment committee for the best actor in each piece. Mr. P. H. Rama Reddi, Mr. R. C. Broadfoot and Mrs. W. V. Ramiah acted as judges.

College Day Athletic Sports 1941.

The annual athletic sports in connection with the College Day and Conference this year was as usual conducted by the Madras Agricultural Students' Union at 3 P. M. on Saturday, 12—7—41. The S. W. monsoon, which year after year threatens but never mars the successful conduct of this much looked for function, was true to its tradition this year also, and cleared up in time on the 12th afternoon, though it had been raining incessantly since the 7th of July, and had even registered a fall of 8 cents on the forenoon of the sports day. Our thanks are due to Mr. H. Shiva Rao, the indefatigable Vice-President of the Students' Club, and his band of voluntary workers who in spite of the weather had had the ground marked and ready for the sports meet.

As a result of the change-over last year to the metric system in the track events all previous records of the college got effaced and the performances last year stood as records for this year. Of these four items in the track events have been bettered this year and in four field events, viz. Pole vault, Hop, step and jump, Javelin throw and Shot put, new records have been set up this year. The championship cup for the year was won by C. V. Govindaswami. An interesting feature of this year's sports meet was the mike and amplifier arrangement hired out from the local Municipality, which enabled announcement to the spectators every detail of the sports events as they were proceeded with, while providing enchanting music in between.

The members of the Madras Agricultural Students' Union were "at home" to the guests assembled at the sports meet. The tea arrangements were ably and well conducted by Mrs. C. M. John and members of the tea committee, to whom the thanks of the Union are immeasurably due.

At 6 P. M. sharp, as per schedule, the sports came to an end. Mr. R. C. Broadfoot, the Principal of the College, congratulated the prize winners, and requested Mrs. Imamuddin, wife of the local District Munsiff, to give away the prizes, who very kindly did so. The president of the sports committee, Mr. A. M. Kulandai then proposed a vote of thanks and the function came to a close. We are very much indebted to the gentlemen, both official and non-official, who very kindly helped us on the sports day as judges, referees and in other capacities. To them in no small measure is due the successful termination of the day's function.

List of Prize Winners.

Cross Country Race (5 miles). (The Norris Cup.) 1. R. M. Sastry. 2. V. Mahimai Doss 3. B. S. Krishnan. Time 43 min. 27 2/5 secs.

Pole Vault. 1. T. Chellappa. 2. C. R. Tiruvengadam. New Record—8 ft.

110 Metres Hurdles. (The Ramaswami Sivan Cup.) 1. I. L. Narasimha Rao. 2. C. V. Govindaswami. 3. S. Krishnaswami. New Record—19 $\frac{3}{5}$ secs.

Shot Put. (16 lbs.) 1. V. D. Kamath. 2. J. P. Nageswara Rao. 3. B. S. Krishnan. New Record—30 ft.

100 Metres Dash. (The Saidapet Old Boys' Cup.) 1. I. L. Narasimha Rao 2. C. V. Govindaswami. 3. R. M. Sastri. New Record—12 1/5 sec.

Long Jump. 1. C. V. Govindaswami. 2. J. Subramaniam. 3. I. L. Narasimha Rao. Distance:— 17 ft. 1¾ in.

Cricket Ball Throw. 1. M. Ch. Kavulatlayya. 2. A. Radhakrishnan. 3. T. Chellappa. Distance—228 ft. 11 5/8 in.

200 Metres Hurdles. 1. C. V. Govindaswami. 2. I. L. Narasimha Rao. New Record—32 1/5 sec.

High Jump. (The Tadulingam Cup). 1. S. Krishnamurthi Rao. 2. C. Ramakantha Reddy. 3. I. L. Narasimha Rao. Height—4′ 8″.

Invitation Race. (800 Metres). 1. L. Veranan, Central Recruit School. R. D. 1006. 2. A. Ramaswami, Union High School. Time. 2 min. 16 1/5 sec.

Hop, Step & Jump. 1. I. L. Narasimha Rao. 2. C. V. Govindaswami. 3. S. Krishnaswami. Distance—36 ft. 5½ in.

400 Metres Race. 1. C. V. Govindaswami. 2. I. L. Narasimha Rao. 3. Ganeshan. Time—60 3/5 sec.

Javelin Throw. 1. V. D. Kamath. 2. B. S. Krishnan. 3. N. R. Adyantaya. New Record—113 ft. 11 in.

1,500 Metres Race. 1. R. M. Sastry. 2. B. S. Krishnan. 3. V. Mahimai Doss. New Record—5 min. 42 3/5 sec.

Old Boys' Race. (Handicap). 1. M. Mukundan. 2. D. Sundararaj. 3. S. Varadarajan. Time:— 13 1/5 sec.

4x 400 Metres Relay Race. (Intertutorial) (The Chunampet Shield). 1 Mr. C. M. John's wards. 2. Mr. K. M. Thoma's wards. Time 4 min. 51 3/5 sec.

Tug of War. (Intertutorial) (The Ramnad Shield). 1. C. R. Srinivasa Ayyangar's wards.

Champion of the year 1941. C. V. Govindaswami—24 points.

Report of the Managing Committee for the year 1940—41.

(Presented to the General Body)

The Managing Committee beg to present the following report of the activities of the Union for the year 1940—41.

Membership. The strength of the Union as it stood on 31st May 1941 was 496 as against 503 of last year and 450 year before last. In spite of this large membership still a large percentage (over 40%) are outside the Union. Despite appeals sent to many officers and subordinates, not more than 4 or 5 officers became members. In this connection our thanks are due to Mr. K. C. Naik for taking interest and being responsible for enlisting the above number. We take this opportunity to appeal to all officers who are not members already to enlist themselves as members and also help the Union in enlisting members in the future. We would also request the students who pass out of the College to continue their membership as they have the benefit of the concessional rate of membership until they are employed.

Office Bearers. Mr. R. C. Broadfoot, our President proceeded on long leave due to ill health but we are very glad he returned after an absence of 10 months in better health. During his absence Rao Bahadur G. N. Rangaswami Ayyangar acted as President. Consequent on the resignation of Mr. P. V. Ramiah, who was elected Vice-President at the last general body meeting, Sri. C. R. Sreenivasa Ayyangar was elected as Vice-President by the resident members.

General Body Meeting. Two general body meetings of the resident members were held on 2—9—40 and 6—3—41. The first meeting was for the election of Vice-President. The other, under the presidency of Rao Bahadur G. N. Rangaswami Ayyangar, was for the consideration of a letter from Sri, N. Balakrishnan

(an ex-student of the College) setting forth the grievances of the unemployed agricultural graduates. The president explained at length what he as Principal had done for furthering the cause of the unemployed students of the College before and after the receipt of the letter from Mr. N. Balakrishnan. He said that possibly the Director of Agriculture had already addressed the Government regarding the employment of agricultural graduates in Departments other than Agriculture and that it would be premature to take further steps till the decision of the Government is known. It was also felt at the meeting that it was necessary to bring to the notice of the heads of other Departments regarding the special aptitude of the B. Sc. Ag. degree holders for services in their Departments. At this meeting it was also resolved to approach the Government for a subvention of Rs. 600 to the Union for enlarging the scope and increasing the utility of the Madras Agricultural Journal as a medium of educative propaganda in agricultural matters pertaining to the Province.

Meetings of the Managing Committee. Nine meetings of the committee were held during the year.

The Madras Agricultural Journal. The journal continued to be published with promptness and regularity during the year. A good number of articles were available for publication and we take great pleasure in recording our thanks to the several authors who have contributed to the success of the journal. We feel the paucity of contributions of general agricultural interest and we appeal to district officers for such. The students' annual supplement to the Madras Agricultural Journal was published along with the April issue of 1941. We record our appreciation of the promptness of our printers, The Scholar Press, Palghat.

Editorial Board. Thirteen meetings of the Editorial Board were held during the year. Consequent on the resignation of Mr. M. Kantiraj, Sri C. S. Krishnaswami was co-opted as a member of the editorial board. We have great pleasure in recording our thanks to Mr. K. M. Thomas, Editor and to the other members of the editorial board for the able and efficient conduct of the journal during the year.

Subscribers. The number of non-member subscribers to the journal during the year was 211 as against 215 of last year and 230 in the previous year. We appeal to the moffusil members to enlist more subscribers and to make the journal more popular in the Presidency.

Exchange List. Thirty-six journals (Indian and Foreign) were on the exchange list during the year as against 32 of last year.

Finance. The auditors' report and the financial statements are now placed before you. (copy enclosed as a supplement to this issue). Our finances have maintained fair progress despite a drop in receipts under donations and entertainments for the College Day which were far below expectations. There is also a fall in subscriptions to the journal due to arrears. We appeal to the members resident and moffusil, to be prompt in the payment of their subscriptions.

War Fund. In accordance with the resolution passed by the general body last year, a sum of Rs. 25 was subscribed to His Excellency the Governor's war fund for Indian defence purposes.

Extension to the Union Buildings. Last year the general body voted an amount of Rs. 800 for expenditure for extension of the Union buildings. The estimate prepared had to be revised and enhanced in accordance with the suggestions of the Public Works Department. An amount of Rs. 1000 is provided in the budget estimates for 1941—42 for this purpose and we hope the general body will sanction this amount.

Ramasastrulu Munagala Prize. In accordance with the decision arrived at the meeting of the general body held last year to open the competition for papers on economic enquiry in one year and for research in another, the managing committee invited papers on economic enquiries this year. Four papers were received. The judges considered the paper on the Economic survey of the Anakapalle Jaggery market by Sri. A. Sankaram as the best and recommended the award of the prize for it. We take this opportunity to congratulate Mr. Sankaram. Our thanks are due to Dr. B. V. Narayanaswami Naidu, Chairman of the committee, Rao Sahib G. Jogiraju and Mr. M. Kantiraj for judging the papers.

Acknowledgements. Now it is our pleasant duty to thank the various members of the Union who helped and co-operated with its activities during the year. We have great pleasure in recording our grateful thanks to the conveners and members of various sub-committees who had whole heartedly helped us in the celebration of the College Day and Conference last year. Our thanks are due to Mr. J. H. Longrigg. Principal of the Forest College, for loaning us tents and chairs last year. We are specially thankful to Mr. & Mrs. Cherian for arranging tea for the visitors on the sports day last year and to Mr. K. M. Thomas for conducting the sports successfully. We are grateful to Sri. Rao Bahadur G. N. Rangaswami Ayyangar who acted as President for over 9 months for his keen interest, active help and guidance in the affairs of the Union. Finally, the Union is greatly indebted to Mr. R. C. Broadfoot, Principal and President of the Union who has always been kind and sympathetic and ever ready to help and guide the Union in managing its affairs.

The Annual General Body Meeting, 1941.

The annual general body meeting of the Madras Agricultural Students' Union was held on Sunday, the 13th July 1941, with Mr. R. C. Broadfoot, President of the Union, in the chair. Eighty-six members were present.

The minutes of the previous meeting were read and adopted. The annual report including the statement of accounts for the year 1940–41 and budget for 1941—42 was then presented by the Secretary.

Next Mr. K. M. Thomas appealed to the members to try to increase the membership in order to improve the Journal further, even though it is self supporting at present. More subscribers are required to improve the finance and with improved finance only the Journal can keep pace, with such a rival as the Indian Farming.

Mr. M. Balakrishnan Nair proposed that the subscription may be reduced to Rs. 2 for officers drawing less than Rs. 50. The president pointed out that it is better brought as a resolution with previous notice and so the proposal was dropped.

The budget for the year 1941–42 was then passed subject to the explanation of the discrepancy pointed out by Mr. P. S. Narayanaswami between the amount of miscellaneous receipts and miscellaneous incomes on pages 3 and 4 of the statement of accounts.

The following office bearers were then elected for 1941–42.

Vice-President :—Sri. C. R. Srinivasa Ayyangar.

Editor :—Sri. S. N. Chandrasekhara Ayyar.

Secretary :—Sri. V. Gomathinayagam Pillai.

Mofussil Vice-Presidents :—Sri. R. Swami Rao, Dr. A. Subba Rao, Sri. K. C. Naik.

Mofussil members for the Council :—Sri. A. Sriraman, Sri. K. Raman Menon, Sri. C. Venkatachalam, Sri. M. Rami Reddi.

Resident members for the Council:—Sri. K. Raghavachari, Rao Sahib V. Muthuswami Iyer, Sri. T. V. Reddi and P. K. Sivasubramanyam (Student).

Manager :—Sri. M. A. Sankara Ayyar.

Treasurer :—Sri. M. S. Purnalingam Pillai.

Members of the Managing Committee:—Sri S. V. Doraiswami Iyer, Sri. T. Nataraj, C. Balasubramaniam and K. V. S. Suryanarayanamurti (Student).

Editorial Board:—Sri. K. M. Thomas, C. M. John, C. S. Krishnaswami and C. L. Sundararajan (Student).

In winding up the proceedings the President, Mr. R. C. Broadfoot, thanked all the members of the Union and the members of the various committees for the successful conduct of the College Day and Conference. He also suggested that in asking Government for subvention for the Journal the necessity for increasing the number of pages for inclusion of more popular articles may be emphasised. Sri C. R. Srinivasa Ayyangar then proposed a hearty vote of thanks to Mr. R. C. Broadfoot for evincing keen interest in the affairs of the Union.

An Economic Survey of the Anakapalle Jaggery Market*

By A. SANKARAM, B. Sc. Ag.,
Madras Agricultural Department.

Introduction. Among the manufactured products of sugarcane, jaggery takes the first place. Its consumption is about two to two and a half times that of white sugar (both indigenous and imported). This shows that jaggery making as a cottage industry is very important in Indian rural economy. In recent years, it has been observed that the cane cultivator is an adept in the art of jaggery manufacture but is uncertain of his legitimate returns owing to the several disabilities he is suffering from, such as chronic indebtedness, want of ready money to meet cultivation charges, high rates of interest charged by money lenders, etc. Besides the wide and unsteady prices for jaggery, the existence of a host of middlemen in jaggery trade, the chaotic system of weights and above all want of properly organised marketing facilities makes jaggery making, as a cottage industry, a risky proposition.

With a view to study the present system of marketing and to find out the possibilities of improvement in the same, an enquiry was carried out at the Anakapalle jaggery market. With the limited facilities available to the author the enquiry was confined to this one important trade centre and the results are presented in this paper.

Area under sugarcane. Sugarcane is an important money crop in the Vizagapatam district and the largest areas are concentrated in Veeravalli, Anakapalle and Sarvasidhi taluks. The Vizagapatam district ranks first in sugarcane area in the Presidency of Madras, Veeravalli taluk taking the first place with an area of 10,000 acres and Anakapalle and Sarvasidhi taluks closely following with 4000 and 1500 acres respectively.

Methods of cane disposal. Out of the total amount of cane produced in the three taluks about 8 to 10 per cent is estimated to go towards seed

* Ramasastrulu—Munagala Prize essay, 1941.

material, 5 to 6 per cent is consumed by the factory at Thummapala and the rest converted into jaggery. The cane used for chewing is a negligible percentage.

Jaggery season. The jaggery season commences with the beginning of December and usually extends to May. The peak transactions in this commodity usually take place during February and March. Ryots from certain villages like Chuchukonda and Ganaparti sell their jaggery during the months of October and November. Thus practically throughout the whole year jaggery will be coming to the market but an active period may be said to last from January to March.

Methods of transport. Ryots within easy reach of the market (within five miles) send the jaggery prepared on the previous day to the market the next day, and women coolies usually bring the jaggery in baskets. Each woman can carry two moulds or one slab. Ryots situated beyond five miles distance engage a cart for transport. Each cart can carry 50 to 60 maunds (1 maund = $22\frac{1}{2}$ lb.) Recently it has been a practice for a group of ryots (8 to 10) to engage a cart on a co-operative basis to send their produce every day to the market.

Market and traders. Anakapalle has been well known as a place from which large quantities of jaggery are exported every year to other Provinces and the States. There is a big jaggery market in the heart of the town. The principal dealers in this trade are the big individual merchants of Anakapalle. Besides these merchants there is at present a Co-operative Loan and Sale Society, which shares a fairly appreciable part of the trade. Supplies of the commodity are made by the ryots in the neighbourhood for sale in the market. Ordinarily the wholesale merchants do not store the commodity for any considerable length of time in their godowns, but try to dispose off their stocks at the earliest possible opportunity. Most of the merchants and the society are only commission agents but there are a few who actually do some speculative business by stocking the product in the hope of getting higher prices at a later date. The Society does not take any part in speculative business but disposes off the commodity received on the same day as far as possible. About a dozen merchants are engaged in the export trade.

Shapes of Jaggery. There are only three different shapes in which jaggery is cast and sold at the Anakapalle market.

1. Moulds (Tel. *Dimmalu*), cast in baskets.
2. Slabs (Tel. *Chakkilu*), cast in shallow pits lined with mats.
3. Buckets (Tel. *Balchilu*), cast in buckets.

The slabs cast in mat-lined pits are said to have particularly good market in Godavari, Kistna, Guntur and Nellore districts as well as locally The 'moulds' and 'buckets' are reputed to be particularly liked in the markets of Northern India and Hyderabad. Each 'mould' weighs 1 to $1\frac{1}{4}$ mds., the 'slab' 3 to 4 mds. and 'bucket' 2 to $2\frac{1}{2}$ mds.

Grading. Systematic grading purely on scientific basis involving the determination of the sugar content and combined impurities is not in practice at the market. However few grades are clearly recognised and these actually govern the ruling prices for different types of jaggery coming to the market. The main factors that have a bearing on the grades are :—

1. Hardness and consistency (Tel. *Ganithamu*)
2. Crystalline structure (Tel. *Ravvakattu*)
3. Colour (Tel. *Rangu*)

Of the three, hardness is the vital factor as the keeping quality of jaggery is entirely dependent on it. This is tested by the sharp metallic sound produced by tapping the block with finger tips. Also the blunt end of a pencil when pressed against the block should not penetrate or leave any mark or impression of the impact. Granted that there is hardness, the crystalline appearance and colour determine the superiority or otherwise of the sample. Observance of a crease made on the surface of the jaggery with the aid of a penknife point will indicate its crystalline nature. The application of the above tests is utilised to differentiate the three grades of jaggery noted below :—

Grade designation.	*Definition of quality.*
1st grade	Hardness, crystalline appearance and creamy yellow colour.
2nd grade	Hardness plus any one of the other two.
3rd grade	All the rest of the jaggery.

It may be noted that the local market grades described above do not involve any tests for degrees of sweetness or the variety of cane from which it is prepared—all jaggeries being regarded as sweet enough. There is a small quantity of extra special type of jaggery getting into the market and it will always fetch a special price in the market This is not to be included under any one of the three grades described. This is the jaggery that is made from B 208 at Mamidipalli. During the course of the enquiry with the Secretary of the local Co-operative Loan and Sale Society the writer came to understand that unless confidence is created in the traders for certified quality of the graded commodity the dealers would insist on testing the jaggery in accordance with their own standards for determination of the quality and ultimately to fix up the market price.

Fixation of market price. Out of the 42 shops in the market there are about 36 shops mainly engaged in jaggery business including the Co-operative Loan and Sale Society. The total quantity of jaggery that comes to each of these shops is assembled on the verandahs of each shop. Experienced coolies grade the commodity into three grades as per standards described. The market dealers go from shop to shop for bidding at the auctions. A reasonable price for the first grade of jaggery is provisionally fixed. The merchants then begin to bid over the standard price and the highest bid struck off will be the price for the first grade of jaggery for the

day. From the price thus fixed for the first grade, the price for the other two grades will accordingly be reduced and fixed. The price on a particular day depends upon the following factors, and their relative influence will be in the order mentioned :—

1. The quantity of jaggery that comes to the market.

2. The demand from merchants that come from other Provinces and States.

3. The quality of jaggery.

4. The particular shape of the jaggery.

TABLE I. Statement showing the monthly average prices of jaggery per maund (22½ lb.) at the Anakapalle market.

Month.	1935			1936			1937			1938			1939		
January	1	4	10	2	10	0	0	11	2	0	11	3	1	6	2
February	1	2	7	0	14	3	0	9	8	0	12	10	1	9	6
March	1	3	5	0	13	5	0	8	4	0	14	4	1	11	1
April	1	5	7	0	12	8	0	9	6	0	15	11	1	15	9
May	1	4	9	0	10	7	0	9	7	1	3	9	2	0	9
June	1	5	4	0	10	6	0	8	0	1	3	1	2	0	2
July	1	4	6	0	11	5	0	11	2	1	5	10	1	13	10
August	1	4	5	0	11	0	0	11	0	1	8	5	1	13	0
September	1	5	9	0	11	5	0	11	2	1	7	1	1	6	1
October	1	7	0	0	13	10	0	11	5	1	11	11	2	0	0
November	1	4	8	0	15	5	0	9	7	1	9	0	1	14	9
December	1	2	5	0	12	11	0	11	4	1	8	11	1	9	5
Yearly average.	1	4	8	0	11	8	0	11	0	1	4	0	1	9	4

Price movements. A close study of the monthly average prices of jaggery per maund (22½ lb.) at the Anakapalle jaggery market from 1935 to 1939 as shown in Table I has warranted the following inferences.

1. The market generally maintains remarkable stability and steadiness in prices in the period from December to February, the fluctuations being negligible.

2. Slight fall in prices during the months of March and April indicate the relatively huge supply in comparision to the low demand. At this part of the year the market generally displays uncertainty and prices decline.

3. The slackening in supply during the period from August to October will make the prices rise to a very favourable limit and *ryots* who stored their commodity during the on season derive much profit at this time.

4. In exceptional years like 1937 the price fell as low as 8 annas per maund and *ryots* could not make both ends meet.

Trade commissions. A detailed statement of the different trade commissions charged at the Anakapalle market is shown in Table II. The average commission per maund ($22\frac{1}{2}$ lb.) of jaggery varies from 9 pies to 1 anna depending on the price of the jaggery. Taking the price of jaggery per maund to vary between 8 annas and Rs. 2 the commission varies from 4 to 9 per cent of the total price of the jaggery. The local market terms are duly explained under Table II.

TABLE II. **Statement showing the Trade Commissions charged at the Anakapalle Jaggery Market.**

Items.	Paid by seller. Rate.	To whom paid	Paid by buyer. Rate.	To whom paid.	Remarks.
Market tolls	0 2 0	Market contractor	...	...	Per cart load.
,,	0 0 3	do	...	...	Per head load.
Kolegaram	Average co. of one vis jaggery	*Kalasis*	...	...	Per $22\frac{1}{2}$ Mds.
Tolai	...	...	0 3 0	*Kalasis*	Per cart load of 60 mds. (including charges for services for sweeper, water carrier, etc.).
Stitching moulds and charges for twine	...	...	1 0 0	*Kalasis*	Per 100 basket moulds.
			1 8 0	,,	Per 100 bucket moulds.
Commission*	0 0 9	Buyer	...	...	Per maund; (if the price of jaggery is Rs. 1-8-0 or above the commission is Re. 0-1-0 per maund.)
Weighing charges	0 0 1	*Kalasis*	...	...	
Vaida Interest	...	...	0 0 9	Seller	Per day for 18 days.
Valtar	...	...	0 8 0	,,	For every Rs. 100.
Cheeti mudra	...	...	0 0 3	,,	do.

*The commission charged depends on the ruling price of jaggery per maund ($22\frac{1}{2}$ lbs.)

Explanation of Market terms.

1. *Market tolls.* A nominal fee charged for getting the jaggery into the market compound for sale.

2. *Kolagaram.* This is the wages paid for *kalasis* (coolies) for the labour involved in the process of unloading the carts, grading jaggery, etc.

3. *Tolai.* A small donation to meet the incidental charges for the facilities provided at the market like keeping clean water to drink.

4. *Vaida* interest. This is a kind of discount made from the amount due from the buyers to the sellers. Payment of cash for the amount of jaggery purchased would effect remission @ 9 pies per Rs. 100 per day until 18 days thereafter, after which period interest shall be calculated at the same rate for the due amount.

5 *Valtar.* This is also called "Hindu discount". In olden days when some of the important banks had not their branches established at Anakapalle it was customary to pay an additional sum of 8 as per every Rs. 100 due from the buyer to the seller (merchants at Anakapalle). This is to meet the incidental charges towards getting the cheques issued by the buyers, cashed on the banks of Vizagapatam or Vizianagaram. Now that the banks are established at Anakapalle, payment in cash is being resorted to as a result of which a sum at the said rate is being deducted from the amount due from the buyer to the seller.

6. *Cheeti mudra.* Whenever payments are made as cheques on banks at Anakapalle, a sum @ 3 pies for every Rs. 100 is paid in addition to the seller. This is to cover the charges of labour involved in getting those cheques cashed.

Produce Movements. The jaggery from the Anakapalle market go as far as Bihar and the United Provinces in the North, and Hyderabad and Travancore in the south. The recently laid out railway line connecting Raipur and Vizagapatam has greatly facilitated the movement of the commodity to Raipur and its surroundings. Besides this, jaggery was known to have been transported to Nagpur and Bombay also. The exact stations to which the commodity is being exported is not known to people other than those who are mainly dealing with the export part of the business. This is a trade secret with the export merchants.

Co-operative Loan and Sale Society. In spite of the sincere efforts of the Co-operative Loan and Sale Society, the local *sowcars* still continue to be the principal money lenders for the cane growers. The *sowcar* will always keep the *ryot* in his clutches and will never bring the money transactions with the *ryot* to a close. Despite the existing visible disadvantages such as high interest and false weighment in transactions with the local *sowcars*, most of the *ryots* continue their dealings with *sowcars* only for the undermentioned reasons :—

1. The *ryot* is always indebted to the *sowcar* and it is his chronic indebtedness that prevents him from clearing his debts.

2. Any amount of money is procurable at a moment's notice without involving any immediate worry on the part of the *ryot*.

3. The cordial reception that the *sowcar* gives to the *ryot* with pleasing words and at times with small tips in the form of presents attracts the *ryots* to him.

It was with the main purpose of avoiding these *sowcars* as principal dealers in the jaggery market a Co-operative Loan and Sale Society was started as early as 1930. The society was mainly instrumental in diverting considerable part of the business (15 to 20 per cent) from the hands of the *sowcar* to the society during the short period of nine years of its working.

Table III shows the extent of business done during a period of nine years. Though some of the *ryots* appreciate the correct weighments and the minimum commission charged, they do not see eye to eye with the society in the matter of dispensing the loans. The *ryot* seldom gets a loan at the time he is in most need. At times he has to wait for two or three months after putting in his application by which time the jaggery season would be over. The delay to provide him a loan easily makes him forget the benefits of the society.

TABLE III. Statement showing the Progress in the Jaggery business done by Anakapalle Co-operative Loan and Sale Society during 1930 to 1939.

Year.	Quantity in Maunds. (Md. 22½ lbs.)	Value in Rs.	Commission Rs.
1930—31	13045	16053	1315
1931--32	39681	45543	2568
1932—33	65283	50566	3999
1933—34	87439	68992	4118
1934—35	113056	138626	5411
1935—36	145116	119049	6689
1936—37	141151	90737	6585
1937—38	115797	95741	5447
1938—39*	117572	187525	6762

*Business of this year (1938—39) is about 15 to 20% of the entire business in the market.

Defects of the present marketing system. This paper would be incomplete without the mention of the inherent defects of the present marketing system which are calculated ta prejudice the interests of the producer as against the interests of the merchants who occupy a decidedly advantageous position. In the first place the whole business of the market is completely in the hands of a few merchants who are experienced in transacting their business for the best part of a century. Secondly the vital aspect of business which has a direct bearing on the net gains of the producer namely the ruling price of the commodity on a particular day is in the hands of merchants, for even at the premises of the society the bidders are only the merchants. Thus the producer ultimately depends for the disposal of his produce on these merchants.

Conclusion. Though the cultivator is an expert in the art of jaggery manufacture, he has no voice in the disposal of his produce and is at the mercy of the merchants who take a disproportionate share of the consumer's price. The formulation of a future marketing policy should be such as to improve the present marketing system in two important directions namely the proper organisation of markets and the systematic grading of the produce.

The lines of organisation of the markets are the inauguration of regulated markets under the Agricultural Produce Marketing and Grading Act, standardisation of weights, licensing of commission agents, regulation of

market charges and allowances and provision of suitable ware-houses. The definite advantages of high premium and the large profits involved in the grading of the produce for the *ryots* needs no special mention. The establishment of grading centres at important jaggery trade centres with definite standards would go a long way in increasing the returns of the jaggery manufacturer.

To make the jaggery manufacturer independent of the loan giving middlemen, a sound marketing policy indicated should be coupled with provision of cheap credit. Co-operation appears to have great potentialities in this direction. The middlemen advance loans before the crop is sown and unless the co-operative societies can furnish to cultivators all the facilities that the middlemen offer them the progress of co-operative effort cannot be rapid or certain. In Baroda, it is learnt, the state has recently commenced the issuing of crop loans for sowing improved types of cotton at 4½ per cent interest. It is obligatory for the farmer who receives the loan to market his produce through co-operative agency. Such a scheme modified to suit the conditions of this Presidency may be tried till co-operative endeavour is able to take up the whole work. A scheme that provides for regulated markets and systematic grading of the produce coupled with the provision of cheap credit through co-operative societies would make jaggery making more paying and would secure for the cane cultivator his due share of the consumer's price which at present is denied to him by innumerable middlemen and unscrupulous traders.

Acknowledgment. I take this opportunity to express my sincere thanks to Sri. C. Ramaswami, M. A., (Cantab.), Junior Lecturer in Agriculture, for his sympathetic criticism and to Sri. T. Nataraj, B. A., B. Sc. (Ag), for the valuable suggestions he has given on the paper I am also thankful to Sri B. Autchanna Naidu, Secretary of the Co-operative Loan and Sale Society, Anakapalle, for all the information he has given me in the course of my enquiries.

Cropping Behaviour In Mangoes.*

By K. C. NAIK, M. Sc., (Bristol).

&

M. MOHAN RAO, B. Sc. (Ag.)

The fairly frequent occurrence of lean years in mango production and the shy bearing tendencies of many reputed varieties are well-known to form the limiting factors in the successful mango culture all over the world. It is commonly assumed that there is alternate bearing or a definite periodicity of bearing in mangoes. Hartless (1914), Burns and Prayag (1921), Sen (1939) and Singh and Khan (1939) have maintained that lean and good years alternate with each other without exception, while Popenoe (1917 and 1927) states that heavy production in *mulgoa* occurs once in

* Paper read at the thirtieth College Day and Conference of the M. A. S. Union, July 1941.

four years in Florida. One of us (Naik 1940) has recently shown that good or bad cropping years occur at indeterminate intervals and do not conform to any alleged conception of rhythmic or cyclic production. The causes of scanty fruiting in many varieties according to the senior author is due partly to the genetic make up of the individual and partly to the varietal characteristics, while those for lean years in mangoes may be mainly environmental influences including pest and disease incidence. On the other hand, Burns and Prayag (1921) and Popenoe (1927) postulate that the problem is a physiological one connected with the nutritional conditions of the tree.

In fruits subject to such erratic production, a knowledge of some of the pre-fruiting characters which influence or govern productivity is essential, in that it furnishes to the grower a means of predicting the size of the crop and of undertaking in advance suitable measures for regulating the future crop-bulk in the desired channel through modification of the concerned pre-fruiting growth features. In the present paper are outlined the results of investigations carried out at the Fruit Research Station, Kodur, from August 1936 to May 1941 on certain commercial varieties of mangoes on the problem of productivity as affected by growth conditions and by certain blossom biological considerations. In mango, where perplexing crop uncertainties upset the growers' expectations occasionally, any effective step towards reducing the swing from heavy to light crops is bound to be of considerable value, and the investigations were all designed with this main objective.

Season of growth, and growth as affected by flowering or fruiting performance. Under Kodur conditions, growth in mangoes is characterised by two active phases, one commencing in February and lasting till June and another occurring in October-November. Minor growth phases may, however, occur mainly in December. The production of a heavy crop of blossom in one season is found to considerably retard the tree-activity in the succeeding season of growth. Shoots which flower but shed the flowers early or in which the fruit drops off at an early stage of development produce a very much larger number of lateral shoots in the subsequent growing season than the non-flowered ones. Shoots that carry fruits to maturity on the other hand either do not produce any laterals at all for the year, or if they give out any, such laterals tend to make poor growth and are mostly produced very late in the year.

Flower Production. With regard to flower production it is observed that panicles are largely borne on the preceding year's growth which may have emerged from the leaders that had either flowered or not flowered that year. Shoots of several years of age have also been noted to produce flowers in some cases, but rarely the fruits are set and carried to maturity on these. During 1940, the percentage of flowering shoots among leaders was 43 in *neelum* and 27 in *bangalora*, whereas among laterals the percentage of cropping shoots was 17 and 18 respectively.

Between the flowered and non-flowered leader or lateral shoots, no statistical difference is observed with regard to flower production in the

succeeding year. Thus the importance of flowered shoots in any given year for the production of flowers in the following season is found to be as great as that of the non-flowered shoots of the same year. The general belief that the shoots that flower in one year are incapable of producing a crop of flowers in the subsequent year is, therefore, erroneous under normal conditions of growth and culture.

It must, however, be admitted that a shoot that flowers need not necessarily carry fruits to maturity. As has already been pointed out, shoots which shed flowers early in the season possess different growth features from those that carried fruits to maturity. Such differential growth features as the poor extension growth and the late production of new growth in shoots that carried fruits to maturity are found to form adverse factors for the production of blossoms in the succeeding season. No profitable crop can therefore be expected from trees which have produced a bumper crop in the previous year and at the same time have failed to record adequate amount of extension growth early in the season on shoots of the previous season. This leads to the conclusion that the effect of flowering on the succeeding year's performance of the shoots is not the same as that of fruiting. Obviously the development of the fruit exerts a more profound influence on the shoot performance in the following year than the production of flowers alone.

The lateral shoots appear to be proportionately of lesser importance than leaders with regard to production of flower buds. Every leader shoot however, is capable of functioning not merely as a single leader but also may produce a number of laterals. Similarly, every lateral shoot is capable of producing in its turn numerous secondary shoots from its axillary buds. Inasmuch as there are a larger number of laterals than leaders on a tree, and that laterals are also found capable of bearing flowers to some extent, it is to be expected that on a tree, panicles borne by the laterals may be far more numerous than those borne by leaders. From this, it may be concluded that because of their larger preponderance in number, the laterals may influence the gross crop-yield to a considerable extent.

The emergence of a high proportion of lateral shoots during the flowering period and the fact that a large proportion of such shoots produce blossoms in the next season are points of great interest and importance, in that the production of flowers and of shoots that flower in the succeeding year go hand in hand, thus ensuring regularity of bearing. Thus, although the importance of leader shoots in determining the crop size has to be recognised, the equally great importance of lateral shoots, especially in varieties wherein they are produced in great abundance, in influencing the gross crop yield and in ensuring regularity of bearing cannot be underestimated. The well-known regular bearing habit of *neelum* is possibly due to its ability to produce a large number of laterals, many of which are potential croppers in the following season.

The time of emergence of lateral shoots is also of considerable importance in regard to blossoming of trees in succeeding years. Observations extending over four flowering seasons have shown that shoots produced in the months of March, April and May produce the largest number of panicles in the succeeding year in all the varieties, excepting in *neelum*, in which those produced in October also bear crop to some extent. This feature of *neelum* is undoubtedly an additional contributory factor for its greater regular bearing habit.

In regard to the period of growth of shoots, observations have shown that trees which ceased growth early, say by the end of May are most prolific in bearing, while those in which the growing was prolonged up to July or August, or which showed growth activity in the season immediately preceding the flowering period failed to produce good crop. An early cessation of growth during the first flush of the previous year as well as a definite dormant period for about a month immediately before the emergence of blossoms are therefore vital for the formation of a good crop of flower buds. It will be recognised that all these favourable conditions for flower-bud initiation such as an abundant production of leader shoots during the first flush, a good extension growth of these, an early growth cessation, a good crop of laterals in varieties like *neelum* and a definite period of dormancy towards the close of the year are subject to be influenced considerably by the prevailing seasonal conditions and to a certain extent by the orchard cultural practices.

Blossoming in relation to varieties and seasonal conditions. The main flowering season under normal climatic conditions for most of the commercial varieties of mangoes grown at Kodur appears to be from December to February. Certain varieties like *neelum*, *rumani*, *allipasand* and *nazukpasand* were observed to produce more than one crop of blossoms and in such cases the period of blossoming and fruit-set are not restricted to any particular periods of the year, depending mainly on the seasonal conditions. The heavy and late rains during 1940 has for example resulted in prolonging the extension growth of shoots during the close of the past year, thus preventing a favourable crop of flowers on one hand, and encouraging on the other the production of an off-season crop of flowers in many varieties in 1941. The dry and relatively rainless summer of 1941 evidently helped the shoots to get the desired dormancy prior to initiation of flower buds. The ability of certain varieties to produce more than one crop of flowers in a year when the first one is destroyed and thereby prolong the fruiting season is a feature of considerable economic interest and importance.

Sex distribution and bearing tendency. The mango panicle is polygamous and bears male and hermaphrodite flowers. Investigations in the 1939 flowering season on 16 varieties have shown that the percentage of perfect flowers varies from 3·47 in *alampur baneshan* to 16·41 in *neelum*. The terminal portions of the panicle were found to have the highest proportion of such flowers, containing more than double the perfect flowers

in *mulgoa*, *baneshan* and *peter*, of that found in the lower parts. This fact is in conformity with the known behaviour of mangoes to bear fruits mostly at the terminal ends.

Observations collected in 1940 flowering season in a young plantation revealed the complete absence of perfect flowers in a panicle of *jahanger*, and a small percentage (0·12) of such flowers in *imampasand*, as compared to 11·7 recorded previously on a 20-year old tree of the same variety. It is possible that the huge variation in the percentage of perfect flowers between trees of the same variety are due to the differing nutritional conditions of the trees or to the differing ages of the trees. At any rate, an extension of the work to elucidate these points seems necessary.

It will be clear that the proportion of perfect flowers in the panicles will be an important determining factor in mango productivity. This has been proved from observations collected in 1940 when a definite positive correlation between the percentage of perfect flowers in the panicle and the number of fruits borne per panicle was established. Thus, *neelum* which has so far shown to possess the highest proportion of perfect flowers produced the maximum number of fruits, while *baneshan* with a relatively poor proportion of such flowers bore a much lesser bulk of fruits. There is reason to believe that, apart from the influence of prefruiting growth characters, the cluster bearing habit of certain varieties and the ability of varieties to withstand damage from high winds are two of the most important contributory causes for regularity of bearing. Of these, the former is undoubtedly associated with a high proportion of perfect flowers while the latter is purely an inherent varietal character.

Marked variations have been observed between varieties in the length of style, length of stamen and distance between stigma and anther tip. The ratio of style length to stamen length has revealed that shorter style length and lower ratios of style length to stamen length observed in certain varieties are helpful in securing a better set of fruits by means of open pollination. This is also a fact that has to be reckoned with in elucidating the causes responsible for heavy yielding nature of some varieties.

Pollination. Several workers (Popenoe, 1917 and Burns and Prayag 1921) have previously shown that mango is eminently suited for cross-pollination. The wide variation between varieties in regard to quality of fruit, yield, time of bearing, regularity of bearing and off-season cropping is also well-established. In order to see how far some of the desirable fruit qualities that are now dispersed in different varieties can be combined, some controlled pollination studies were undertaken in 1939 and were continued during the 1940 and 1941 flowering seasons. Of the 3,561 flowers pollinated, 1,093 set fruits, 48 matured and only 26 were finally available for harvest. These results are obviously unsatisfactory, in view of the fact that observations here and elsewhere have indicated the necessity for pollination in mangoes. But if it is remembered that a mango tree in normal years is capable of producing five to ten thousand panicles, each

with 1,000 to 1,500 flowers. The above figures need not be a matter of surprise and dissatisfaction, as even with about 2% perfect flowers per panicle and with only 1% of these carrying fruits to maturity, the yield from the tree cannot but be high. The data however indicate that a high proportion of perfect flowers when pollinated with the pollen of compatible varieties will be of far reaching importance in ensuring regularity of bearing. Although the available data do not warrant any valid inference in regard to the suitable pollenizers for our cultivated mangoes, strong evidence points out to the suitability of *panchadarakalasa* as a pollenizer for *baneshan*, *bangalora*, *neelum* and *chinnasuvarnarekha*, and baneshan as pollenizer for neelum, jehangir, and bangalora.

Application of Results. Erratic crop production is a special feature of most of our cultivated mango varieties. It has recently been found out at Kodur (Naik 1940) from a study of a number of varieties over a four-year period that there are a very large number of inherently unfruitful or excessively irregular bearing trees in commercial plantations in the Ceded Districts. It would therefore seem that, apart from the proper and regulated supplies of fruits in our internal markets, the main line of activities for the stabilisation and development of mango industry would lie primarily in (1) the planting of choice fruiting, regular bearing, productive and standardized varieties (2) the increase of orchard efficiency so as to obtain the maximum crop every year and (3) the regulation of mango crop by suitable cultural practices with a view to guarantee normal crop and avoid partial or total crop failure in any season.

The data collected at Kodur clearly indicate that, despite wide variation between varieties in regard to growth, there appears to be some easily distinguishable relationship between flower-bud formation and growth characters in the preceding seasons. Since growth in its turn is influenced by a variety of factors such as seasonal conditions, nutritional problems and cultural practices, it is necessary to gain an insight into the effect of all these individually and collectively with the various interplays between themselves for obtaining a full understanding of the contributory causes of the productivity.

While the importance of cultural practices can never be minimised in profitable fruit production, it is essential to recognise certain limitations of such practices also. That selection of parents has a determining influence has already been emphasised. Another factor that has been shown to govern productivity is the proportion of perfect flowers in the panicles. It has also been shown that heavy bearing is associated with the ratio of style length to stamen length. Obviously these features are at present incapable of being altered by cultural practices alone. Hybridisation may offer a possibility, and therefore the importance of a comprehensive scheme of breeding in mangoes is obvious. Rich collection of mango varieties representing the choicest germ plasm has been made or is still being

made in many centres, and an excellent opportunity is available for utilization of this material. The study into the possible methods of improvement of controlled pollination and of the varietal peculiarities should necessarily precede any hybridisation programme.

The effective control of mango production cannot be sought through a limited sphere of research alone. Selection of off season or double or triple cropping varieties, and of those that are capable of producing one or more crops of flowers when the first one is destroyed, appears to be the problem that demands special attention from workers on mango. Selection of more regular bearing varieties of those that bear fruits in clusters and can withstand heavy winds, as well as of prolific individual parents are yet other profitable lines of work which should rightly engage the serious attention of the fruit grower, nurseryman and the horticultural worker alike.

Acknowledgments. A number of assistants and honorary workers have helped in the conduct of this work at different stages of its progress. The authors desire to record their thanks to all these persons as well as to the Imperial Council of Agricultural Research and the Provincial Government under whose joint auspices the investigations were conducted.

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ABSTRACTS

A brief account of the studies on the harmful after-effects of *cholam* crop on cotton. V. Ramanatha Iyer and S. Sundaram. *Indian Journal of Agricultural Science 11,* (1941).

On the rain-fed black soils of the 'Tinnies" tract, farmers generally follow a four-course rotation of *cholam*—cotton—*cumbu*—cotton. It is commonly observed there that cotton grown after *cholam* is paler in appearance. shorter in growth and poorer in yield than that coming after *cumbu*. According to the data collected at Koilpatti Agricultural Research Station during the past 31 years, the average yield of kapas in the former is 405 lb. as against 471 lb. in the latter This phenomenon has not been peculiar to the "Tinnies" tract alone but has been observed to exist under conditions obtaining in Coimbatore, Salem and South Arcot of the Madras Presidency, in parts of Bombay and the United Provinces; and is said by American agronomists as a much dreaded feature of *cholam* growing in their arid and semi-arid tracts. Different hypotheses have been put forward by different American workers concerning the nature and

causes of the phenomenon. Three important causes attributed by three different schools of thought are (i) the greater depletion of plant foods by the heavier feeding *cholam* crop—the same opinion is shared by the farmers of the Tinnies tract. (ii) the production of an easily volatizable toxic body during the decomposition of cholam residues which kill all the micro-flora and (iii) the higher sugar contents of the *cholam* stubbles, which encouraged rapid multiplication of micro organisms and created a nitrogen deficiency in the soil. The results of the present study have, however, led the authors to the following conclusions:—

(a) The diminished yield of cotton obtained in the tract on fields cropped with *cholam* during the previous year is found to be caused neither by lack of soil moisture nor by exhaustion of soil nutritives, nor by the presence of toxic products of decomposition; (b) The harmful effects could not be improved by the application of manures, the reduction of plant population or by mixing *cholam* with pulses; (c) Seed setting and duration of *cholam* were observed to influence the intensity of the deleterious effects of cholam cropping. since the *cholam* effect was not manifest in the crop cut at shot blade. This phenomenon could be ascribed to the normal penetration of the *cholam* roots into the alkaline regions of the soil below the second foot. (d) the growing of both *cumbu* and *cholam* disturbed diffently the sodium ion contents of the soil. In soils cropped with *cholam*, the rise of replaceable sodium was greater with the growth of crop, but its later decline was much slower than that observed in the case of *cumbu* plots. As a consequence former soils were left more alkaline at the time of cotton sowing, which condition would appear to be responsible for the lower yields recorded after *cholam* crops. (e) Correctives for alkalinity could not give conclusive results owing to unfavourable seasonal conditions. It was however, inferred that their application in the lower layers might show better response. (f) *Cholam* could not be replaced by other fodders, (g) Ploughing experiments showed that these soils were not benefited by cultivating them prior to sowing cotton. A saving in the cost of cultivation might be effected by reducing the preparatory cultivation to the minimum. (h) Thick sowing of cotton improved the yields of cotton in "after *cholam*" plots, both in good and poor seasons of rainfall K. R.

Composition of the alcohol extract of sugarcane leaves as a means of determining soil fertility. C. E. Beauchamp, *Proceedings 13th Ann. Conf. Asoc. Tecnicos Azucareros Cuba*, 1939, 273—284.

In previous work it was shown that the mineral content of the alcohol extract of sugarcane leaves was intimately correlated with fertilizer applications and with the final yields of this crop. It is now shown that the same principle may be used to determine the potential fertility of different soils for sugarcane. Plots of soil were fertilized with different amounts and proportions of N, P_2O_5 aud K_2O; at a certain age of the cane, samples of leaves of the same order were taken and extracted with alcohol, and the mineral content of the alcohol extract was determined by analysis; from these results the "intensity of nutrition" of the plants was calculated; this figure is composed of the sum of percentages of N, P_2O_5 and K_2O. The intensity of nutrition shows an intimate correlation with cane yields in terms of field weight and sugar content.

In practice, this would be applied as follows: part of the cane field would be fertilized and the rest left unfertilized. The field will then be planted, and when the cane is 3½ months old samples of the leaves will be taken and the mineral content of the alcohol extract found by analysis. If the leaves from the fertilized portion show a higher intensity of nutrition than those from the unfertilized portion of the soil, the crop will doubtless be benefited by a timely application of that particular fertilizer when harvested 22 months after planting.

This method may also be used to compare the apparent fertility of two different fields planted to the same variety at the same time. In terms of the respective levels of nutrition of two different fields of different yielding capacity it may be possible to fertilize the lower yielding field so that its ultimate yield may approach that of the higher yielding field. With suitable modifications the method may be useful in comparing ifferent cane varieties. *(Facts About Sugar*, 35 (Dec. 1940) : 42.) K. M. T.

Gleanings.

Minute amounts of chemical elements in relation to plant growth. For a long time it was generally believed that only the ten elements, nitrogen, phosphorus, sulphur, calcium, magnesium, potassium, iron, carbon, hydrogen and oxygen were indispensable for the growth of higher plants. Actually in 1869 investigations were carried out on the effects on plants of manganese and zinc ; the significance of the results obtained were overlooked and it was not until much later that it was realised that the requirement for normal growth of plants included other elements than "the ten". In 1923 it was definitely established that boron played an essential role in the development of broad bean and other plants, and more recently there has been general recognition of the relationship between certain "minor" elements and some of the physiological diseases of plants. In experiments carried out with water culture, it was found in 1923 that manganese was an indispensable component of a satisfactory nutrient solution. Subsequently the necessity for varying amounts of boron, copper and zinc was discovered. Many plant diseases are now known to be due to deficiencies of these elements As an example may be cited "mottle leaf" of citrus in South Africa; this is a zinc deficiency and the standard treatment is application of zinc sulphate.

More recently other elements have become known as essential and the increasing interest of this phase of agriculture is evidenced by the extensive literature on the subject. A bibliography compiled in 1935 and 1936 revealed about 3,000 references to some 30 minor elements classified as essential to plants, unessential and doubtful.—*Jour. Jamaica Agri. Soc.* 44 (1940): 438–439.

Value of peanuts*. Of the many things in favour of peanuts the following stand out as most prominent :—

1. Like all other members of the pod-bearing family, they enrich the soil.
2. They are easily and cheaply grown.
3. For man the nuts possess a wider range of food values than any other legume.
4. The nutritive value of the hay as a stock food compares favourably with that of the cow pea.
5. They are easy to plant, easy to grow and easy to harvest.
6. The great food and forage value of the peanut will increase in proportion to the rapidity with which we make it a real study. This will increase consumption, and therefore, must increase production.
7. Two crops per year can be raised.
8. The peanut exerts a dietetic or a medicinal effect upon the human system that is very desirable.
9. There is no other foodstuff that can be so universally eaten, in some form by every individual.
10. Pork fattened on peanuts and hardened off with a little corn just before killing, is almost if not quite equal to the famous Red-gravy hams or the world-renowned Beechnut breakfast bacon.

* Groundnut.

11. The nuts yield a high percentage of oil of superior quality.

12. The clean cake, after the oil has been removed, is very high in muscle-building properties (protein) and the ease with which the meal blends in with flour, meal, etc., makes it of especial value to bakers, confectioners, candy-makers and ice cream factories.

13. Peanut oil is one of the best known vegetable oils.

14 A pound of peanuts contain a little more of the body-building nutrients than a pound of sirloin steak, while of the heat and energy producing nutrients has more than twice as much. (*Jouraica Jamaica Agri. Soc.* 44 (1940) : 285).

Review.

Hand Book of Economic Entomology for South India. By T. V. Ramakrishna Ayyar. B. A., Ph. D., Government Entomologist, Madras (Retired,, formerly fellow of the Zoological and Entomological Societies of London—for sometime member of the Senate, the Academic Council and of the Boards of Studies in Zoology and Agriculture of the Madras University and Examiner in Agricultural Zoology for the Madras, Bombay and Punjab Universities.

It has to be admitted that in India our knowledge of the numerous relations existing between human beings and lower animals is unfortunately very meagre and especially is it so with regard to the various roles which insects play in different aspects of human activities. The periodical incursions of locusts, caterpillars and bugs and the serious loss thereby caused to cultivators, are familiar examples of the injurious work done by insects to our primary needs of life, viz., food materials ; the recent discoveries by scientists that small and apparently innocent creatures like the mosquito, house fly, etc., are capable of disseminating some of the deadly diseases among men and cattle are other examples of insect interference with human activities. Nor are we sufficiently aware of the beneficial roles played by some insects like bees, silkworms, lac insect, etc. It is therefore evident that a knowledge of the economic aspects of insect activities will be very useful to all of us, especially to cultivators, cattle breeders and provision dealers. Studies have been made in these lines in South India for some years past and the Madras Agricultural Department has been carrying on investigations especially on insects affecting agriculture to help the cultivator with advice to control injurious insects and take advantage of the beneficial ones. The results of the studies so far made have been summarised briefly by Dr. T. V. Ramakrishna Ayyar, (until recently Government Entomologist, Madras), in a handbook which is now published by the Madras Government with the idea that it may help the agricultural student, the educated cultivator and all those interested in Economic Entomology. It may also be added that though the book is primarily on South Indian insects it will be found useful to students and farmers in other Provinces also in India since most of the insects noted in the book are also found in the agricultural tracts of areas outside South India.

The matter in the book which runs to 517 pages is conveniently divided into two parts—the first part, including the first six chapters is on general Entomology and deals with the fundamental characters connected with the structure, life history and habits of insects in general, so as to serve as an introduction to them, the more important matter in Part II which deals with the various South Indian insects of economic importance, such aspects of different field crops, stored products, etc., and the beneficial insects like silk worms, the lac insect, honey bees and friendly forms. Part I will be found very helpful to the beginner in Entomology and to amateur farmers to understand more clearly the matter in Part II.

The first five chapters of Part II deal with insect pests of crops in general, the different categories of such pests; general factors regarding pest outbreaks and the various methods of control which may be adopted to suit different pests found in different localities and under different natural conditions. From chapter X the subject matter is devoted to pests of different crops such as those of paddy, millets, cotton, oil-seeds crops, fruit crops etc. There are also chapters dealing with insect pests of cattle and stored products, household and disease carrying insects and beneficial forms like parasites, predators, etc.

As a supplement to these chapters are added a few appendices on (1) the systematic arrangement of pests, (2) on insect classification, (3) on hints and formulae to collect and treat insect pests and on insect technique, (4) on some non-insect pests of crops and insectivorous animals and (5) a Bibliography on South Indian Economic Entomology including the more important publications on the subject for the past thirty years.

The book is profusely illustrated with a very interesting coloured frontispiece on paddy insects; the printing and get up of the book are also found to be satisfactory. With all its inevitable short comings it is presumed that the book will be found very useful to all students of agriculture, economic entomologists, educated farmers and orchardists.

The book is priced very low (Rs. 4/12) especially in view of the number of illustrations (413 in number+coloured frontispiece) which considerably enhance the scientific and practical value of the publication.

Copies of the book can be had of the Superintendent, Government Press, Madras, and the Director of Agriculture, Madras.

Crop and Trade Reports.

Statistics—Crop—Groundnut—1941—Summer and early crops—Condition report. Sowings of the summer crop of groundnut are generally restricted in all districts owing to (i) want of timely sowing rains, (ii) propaganda for the restriction of groundnut cultivation and (iii) the low price of groundnut at the time of sowing. Sowings of the early crop in the districts of Salem and Coimbatore are reported to be below normal due to the late receipt of sowing rains.

Harvest of the summer crop of groundnut has commenced in parts. The yield per acre is expected to be normal in Chingleput, South Arcot, North Arcot and Madura and below normal in the other districts. The condition of the early crop of groundnut is satisfactory.

The wholesale price of groundnut (shelled) per Imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important market centres on 7th July 1941 was Rs. 4—4—0 in Vizagapatam, Rs. 4—2—0 in Vizianagaram and Cuddalore, Rs. 3—15—0 in Guntur, Rs. 3—12-0 in Vellore, Rs. 3—11—0 in Cuddapah, Rs. 3—7—0 in Salem, Rs 3—5—0 in Adoni and Bellary, Rs. 3—4—0 in Hindupur, Rs. 2—15—0 in Tadpatri and Rs. 2—14—0 in Nandyal. When compared with the prices published in the last report, i. e., those which prevailed on 7th April 1941, these prices reveal a rise of approximately 20 per cent in Cuddapah, 18 per cent in Vizianagaram and Vellore, 16 per cent in Cuddalore, 13 per cent in Vizagapatam, Adoni and Hindupur, ten per cent in Nandyal, Bellary and Salem, nine per cent in Guntur and four per cent in Tadpatri.

(From the Director of Industries and Commerce, Madras).

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 18th July 1941 amounted to 435,828 bales of 400 lb. lint, as against an estimate of 503,500 bales of the total crop of 1940—41. The receipts in the corresponding period of the previous year were 364,678 bales. 386,630 bales mainly of pressed cotton were received at spinning mills and 30,603 bales were exported by sea while 92,905 bales were imported by sea mainly from Karachi and Bombay.

(From the Director of Agriculture, Madras).

Mofussil News and Notes.

Karur. *Agricultural excursion.* The Headmistress and Assistants of the Government Training School, Karur, led a party of 200 pupils and pupil teachers, on an agricultural excursion to Melapalayam on 12—7—41, leaving Karur by 3·18 P. M. train. They reached Senaipirathi R. S. within 10 minutes of their departure and they were taken by the local Demonstrator to the village about 6 furlongs from the station. One of the objects which created much interest in the pupils was a coconut tree with 7 branches at the crown. The village site, the fields round-about, the standing crops of groundnut, turmeric and onions, were shown to them. Details about the economics of growing money crops, the village cottage industries such as pottery, oil mill, mat-weaving and bee-keeping were explained to them by the Demonstrator. Ideal cattle sheds and manure pits were also seen. The party returned to Karur by 7 P. M.

The Secretary, Agricultural association, Karur, who is also the village Headman of Melapalayam helped in furnishing details about village life. A. R. K.

Tiruchengode. Under the auspices of the Tiruchengode taluk association for rural uplift and amusements, a taluk tournament and rural exhibition were held at Tiruchengode (Salem district) from 27—6—41 to 1—7—41. On this occasion an agricultural exhibition was arranged and this was visited by about 200 ryots from the surrounding villages every day. Improved implements suited to the tract, departmental strains of paddy and cotton, cream jaggery, posters explaining the preservation of manure, control of diseases and pests, bee-keeping and specimens of green manure crops, were exhibited. Fruits and vegetables produced by ryots and honey extracted from hives maintained by private individuals were other interesting items. The departments of Health and Veterinary also participated. The rural uplift van with loud speaker maintained by the Salem District Board was available on the opening and closing days. The Revenue Divisional Officer, Sankaridrug, opened the exhibition in the presence of a large gathering and the Dy. Registrar of Co-operative Societies and Special Development Officer, Salem, were also present. On the final day various rural games organised as counter attractions against drink were arranged and prizes were distributed by R. M. Sundaram, Esq. I. C. S., Collector of Salem. The function was largely attended and among those present were the Revenue Divisional Officer, the Dy. Registrar of Co-operative Societies, District Agricultural Officer and Special Development Officer, Salem and Assistant Marketing Officer, New Delhi. R. C.

Tiruppur. The annual car festival at Tiruppur comes off in the *Visaka Nakshatra* in the Tamil month of *Vaikasi* (May—June). On this occasion, a large-scale cattle fair is held here. Horses, ponies, sheep, etc., are also brought to the fair. Tiruppur being close to the famous Kangayam breeding tract, the majority of the cattle brought to the fair are 'Kangayams' which are poor milkers but the best fitted for hard draught work.

The District Agricultural Association, Coimbatore, usually arranges a Cattle and Pony Show with an Agricultural and Industrial exhibition in alternate years to encourage better production of cattle, sheep, horses and ponies, agriculture and other industries by awarding a very large number of prizes to a money value of about Rs. 1500 in the shape of gold and silver medals and cash for the best exhibits of different category. The shows and exhibitions during such years become very important and attract a large congregation of ryots from all over the district of Coimbatore and other Tamil districts. The show is specially important as the best cattle in the district of Coimbatore, the famous Kangayam breed, are brought for exhibition and sale. The Pattagar of Palayakottai is the best reputed breeder of Kangayams and usually puts up the largest number of the best animals of different category and most of the prize animals entered for competition are those belonging to him.

This year the car festival came off on the 7th June 1941. The District Agricultural Association, Coimbatore, arranged the 23rd Cattle and Pony Show with the Agricultural and Industrial exhibition from the 10th to 12th June. The exhibitions were staged by the various Departments of Government, as Agricultural, Veterinary, Industries, Public Health, etc. and private individuals also took part in the show and exhibitions. A very large number of cattle, horses, and ponies, were brought from within and outside the district and far off places as Ahmedabad, Benares, etc. The cattle consisted of pure Kangayam-cows, heifers bulls and calves of different ages, stud bulls, work-bullocks, local, Alambadi, buffaloes, etc. About 10,000 heads of cattle will not be a wrong estimate.

The Agricultural Department put up the show as usual with a large collection of improved implements, machinery, strains of crops, different fodders, finished products as malts, malt-preparations, cream jaggery, banana figs, banana flour, fruits, vegetables, diseased specimens of crops damaged by insects and fungi, specimens of insects appliances for control measures; sidelines of farming, poultry, apiculture, manures and manure seeds, model cattle sheds, silage pits, several charts and posters on agricultural subjects. *Ryots* of different taluks in the district also entered into competition and won 25 cash prizes and certificates of merit.

The show and exhibition were opened by A. R. C. Westlake Esq., I. C. S. District Collector, Coimbatore, on the 10th and the prizes were distributed by T. J. Hurley Esq., Director of Veterinary services, Madras, on the 12th June.

M. S. P.

Samalkot. The old boys of the Agricultural College, Coimbatore, employed on the Agricultural Research Station, Samalkot and in some of the taluqs in the Godavary Districts assembled on 10—7—41 at the Farm and celebrated the Agricultural College Day in a fitting manner with Sri. S. Sitarama Patrudu District Agricultural Officer, Cocanada presiding over the celebrations. Sri. M. Satyanarayana, Farm Manager, T. Lakshmipathi Rao, Agricultural Demonstrator, and the President made vivid references to the college life and the unique privilege the sons of the *alma mater* have in serving the country. The simultaneous celebrations of the function by the daughter institutions scattered over various parts of the Presidency is a new note struck by the President. Full thirty years have passed since the institution at Coimbatore sent out its first batch of students and retirements have also started with Rao Bahadur K. T. Alwa from that batch. Growing from strength to strength the old boys in distant districts ever keep nascent their comradeship through annual celebrations in such manner.

War fund meeting. Collections were also made for war fund from the assembled and remitted to the Secretary, District War Committee, East Godavari.

M. S.

College and Estate News.

Students' Corner. At the first general body meeting of the Students' club held on the 25th June with Sri. H. Shiva Rao, the Vice-President of the Students' Club, in the chair, the following office bearers of the Students' Club were unanimously elected for the year 1941—42.

Club Secretary	Mr. H. Gurubasavaraj.
Games Secretary	„ M. C. H. Koulutalayya.
Cricket Captain	„ V Devadass Kamath.
Tennis Captain	„ P. Y. Chintamani.
Hockey Captain	„ T. I. Narasimha Rao.
Foot-ball Captain	„ Mirza Anser Baig
Badminton	„ S Ramanadham.
Volley ball	„ T. P. Nageswara Rao
III Class Representative	„ K. Ranga Rao.
II Class Representative	„ C Srinivasan.

After the first year was formed on the 14th of July Sri. K. R. Narayanaswami, B. A., was elected as the representative of that class.

The students entertained Sri. K. Sanjiva Shetty, Assistant Lecturer in Agriculture, at Tea on Friday, the 26th June, on the eve of his transfer to Udipi as Agricultural Demonstrator.

The second general body meeting of the Students' Club was held on Thursday, the 17th July, with Sri. H. Shiva Rao, the Vice-President, in the chair, to consider the budget for the year. Allotments were made to various activities of the club Dailies, literary and scientific journals and other magazines also were voted for for the year.

The senior students of the college welcomed the first year and the short course students at a Tea party held on the 18th of July when Mr. R. C. Broadfoot, the Principal, presided over the function. There were present also at the function a number of officers from both the research and teaching staff.

Cricket match. Taking advantage of the presence of a number of officers,- who had distinguished themselves in games while at College,—on the occasion of the College Day and Conference an enjoyable cricket match was played in a holiday spirit between the 'old boys' and the College eleven on Sunday, the 13th July. G. S. Dutt (brother of Mr. N. L Dutt) of the Lahore University eleven assisted the College. Although Kamath, the College captain correctly named the coin, he very sportingly allowed the 'old boys' to have the first tenancy at the wicket. The 'old boys' compiled a creditable score of 220 runs for 8 wickets to which K. M. Narayanan made a valuable contribution of 114 runs in an attractive innings and retired.

The College eleven commenced batting soon after tea, Dutt and Krishnan who opened the innings gave a good start but the others who followed failed to turn it to advantage. The young Lahore University player played a neat and forcing game for his 89 making delightful strokes all round the wicket. The College team's career was brought to a close at 141 runs.

'*Old boys*'. S. Varadarajan (Captain) K M. Narayanan, M. Mukundan, T. S. Laksmanan, K. Santanam, N. M. Naidu, E. S. Kothandaraman, Kanakaraj David, N. R. Nagaraja Rao, N. Baskara Reddy and C. K. V. Manian.

College. V. D. Kamath (Captain), B. S. Krishnan, C. Sankara Rao, Tiruvengadam, K. Vijayaraghavan, Narasimham, Krishnamurthi, Radhakrishnan, Ramachandran, G. S. Dutt and H. Shiva Rau.

Milk supply to residents of the Estate from the College Dairy stopped. The Government Order No. 771 Development dated 22nd April 1941 states that the College Dairy should be converted into a purely educational concern and the herd on the farm should therefore be reduced.

In accordance with the G. O. the milk supply to the residents of the estate has been stopped from 1st July 1941.

A. R. P. Lectures. Under the auspices of the Coimbatore Agricultural College and Research Institute Division of the St. John Ambulance Brigade overseas, two very interesting and exceedingly instructive A. R. P. (Air Raid Precaution) lectures were very kindly delivered by Dr. M. C. Condillac, District Medical Officer, Podanur, on the 14th and 21st July at the Freeman Hall when Mr. R. C. Broadfoot, the Principal, presided. The lectures were illustrated with explanatory drawings which were projected on the screen by means of the epidiascope with the kind assistance of Mr. B. M. Lakshmipathi Mudaliar, the Research Engineer. On both the occasions Dr. K. Narayanan thanked the lecturer as well as the President for all their kindness.

The Association of the Upper Subordinate Officers of the Madras Agricultural Department.

The Annual general body meeting of the above Association was held on the 13th July in the Freeman Hall with Sri. D. Marudarajan, President, in the chair.

The Minutes of the last general body meeting were read by the Secretary, Sri. M. S. Kylasam and adopted by the general body. The Annual Report for 1940—41 was then presented which was also adopted unanimously.

The following office bearers were elected for the year 1941—42.

Sri. S. Ramachandra Ayyar	*President.*
,, M. S. Kylasam	*Secretary.*
,, S. V. Doraiswami ,, T. S. Ramakrishnan ,, T. Venkataramana Reddi	*Members of the working committee.*

Sri. T. Natraj proposed a vote of thanks to the retiring committee. The Meeting then adjourned to tea.

Weather Review—JUNE 1941.

RAINFALL DATA

Division	Station.	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	7·9	+2·1	9·0
	Calingapatam	5·2	+0·5	6·7
	Vizagapatam	6·8	+1·9	12·7
	Anakapalli*	3·5	-1·0	10·8
	Samalkota*			
	Maruteru*	11·0	+6·7	11·5
	Cocanada	26·2	+21·4	30·1
	Masulipatam	5·1	+0·6	5·6
	Guntur*	3·7	+0·4	5·2
Ceded Dists.	Kurnool	1·2	-1·7	2·0
	Nandyal*	3·0	-1·4	4·5
	Hagari*	0·9	-0·9	3·5
	Siruguppa*	3·4	+0·5	7·0
	Bellary	0·9	-1·0	6·8
	Anantapur	1·0	-1·0	2·7
	Rentachintala	1·9		3·2
	Cuddapah	3·5	+0·6	6·6
	Anantharajupet*	2·5	+0·2	0·0
Carnatic	Nellore	2·9	+1·6	3·1
	Madras	3·8	+1·9	4·7
	Palur*	0·0	0·0	0·0
	Tindivanam*	1·1	-1·1	2·6
	Cuddalore	0·2	-1·3	6·8
Central	Vellore	1·4	-1·0	4·9
	Gudiyattam*	0·8	-1·7	3·9
	Salem	1·4	-1·6	9·7
	Coimbatore	6·2	+4·5	11·9
	Coimbatore A. C. & R. I.*	6·6	+5·1	12·9
	Trichinopoly	0·0	-1·4	3·5

Division	Station	Actual for month	Departure from normal @	Total since 1st Janaruy
South	Negapatam	0·0	-1·3	4·7
	Aduthurai*	0·0	-1·5	5·2
	Madura	1·5	+0·1	11·4
	Pamban	0·3	+0·2	8·9
	Koilpatti*	0·3	-0·2	5·8
	Palamkottah	0·2	-0·4	7·4
West Coast	Trivandrum	12·7	+0·0	35·8
	Cochin	35·1	+6·6	57·2
	Calicut	40·3	+6·2	68·1
	Pattambi*	39·4	+16·0	67·6
	Taliparamba*	43·6	+6·2	53·7
	Kasargode*	48·6	+9·9	55·5
	Nileshwar*	53·3	+12·6	63·8
	Mangalore	30·6	-6·2	35·0
Mysore and Coorg	Chitaldrug	2·1	-0·7	4·5
	Bangalore	3·9	+1·0	10·8
	Mysore	4·2	+1·3	16·1
	Mercara	37·8	+11·4	48·2
Hills	Kodaikanal	4·4	+0·3	15·7
	Coonoor			
	Ootacamund*	9·4	+6·1	19·8
	Nanjanad*	11·6	+3·6	20·9

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated up to 1937 (published in Fort St. George Gazette).

Weather Review for July 1941.

The depression which formed in the west Central Bay at the end of May deepened on the 2nd and occasioned locally heavy rain, Cocanada reporting a record fall of 19·7". The depression became unimportant the next day. Another depression formed at the head of the Bay on the 4th and intensifying into a cyclonic storm crossed the coast near Cox's Bazaar on the 5th and weakened thereafter.

A third depression formed at the head of the Bay on the 14th and passed inland by the 16th and filled up. Conditions again became unsettled at the head of the Bay on the 22nd and developed into a depression by the 24th, but weakened by the 26th, and again developed with a shallow depression near Saugor Island on the next day and by the end of the month still lay centred off the Orissa Coast.

The monsoon was generally strong throughout the month on the West Coast of the peninsula and in the North Madras Coast and Orissa. Rainfall was in large excess on the West Coast, parts of Circars, Mysore and Coorg and the Hills and in slight defect elsewhere.

The chief falls reported are:

Cocanada	19·7"	2nd
Pattambi	11·99"	
Calicut	9·8"	10th
Pilicode	8·1"	10th
Taliparamba	7·7"	
Cochin	6·2	12th
Kasaragod	6·0"	12th
Coimbatore A. C. R. I.	5·8"	9th
Nanjanad	5·6"	8th
Mangalore	4·0"	8th

Weather Report for the Agricultural College and Research Institute Observatory.

Report No. 6/41.

Absolute maximum in shade	...	92·0°F
Absolute minimum in shade	...	67·8'F
Mean maximum in shade	...	87·5°F
Departure from normal	...	−1·5°F
Mean minimum in shade	...	73·7°F
Departure from normal	...	+0·6°F
Total rainfall for the month	...	6·56"
Departure from normal	...	+5·08"
Heaviest fall in 24 hours		5·75" on the 9th (*Record fall*)
Total number of rainy days	...	2
Mean daily wind velocity	...	4·7 M. P. H.
Departure from normal	...	−2·7 ,,
Mean humidity at 8 hours	...	68·3%
Departure from normal	...	−1·2%

Summary. There was a thunderstorm of 5·75" on the 9th which is a record fall. The regular South West monsoon set in with the characteristic south-westerly wind towards the last week of the month. The day temperatures were below normal while the night temperatures were slightly above normal. The humidity was in defect while the rainfall was in large excess of the normal.

P. V. R. & S. V. K.

Departmental Notifications.

Gazetted Services.

1. Appointment.

Sri. S. Ramachandra Ayyar, permanent Assistant in Entomology, is appointed to officiate as Assistant Entomologist, Coimbatore, in category 6, class 1, Madras Agricultural Service *Vice* Sri. T. V. Subrahmanya Ayyar granted leave.

2. Leave.

Name of officers.	Period of leave.
Janab Saadat-ul-lah Khan Sahib Bahadur, Dy. Director of Agriculture	Leave on half average pay for 2 months from 3—7—41.
Sri. K. Ramayya, Paddy Specialist on foreign service as Geneticist and Botanist, Indore,	L. a. p. for 1 month from the date of relief.
Sri. T. V. Subramanya Ayyar, Asst. Entomologist, Coimbatore,	L. a. p for 1 month from the date of relief.
,, V. T. Subbayya Mudaliar, Dist. Agricultural Officer, Bellary,	L. a. p. for 6 months from the date of relief

Subordinate Service.

1. Appointments.

1. Sri. S. M. Kalyanarama Ayyar, Assistant in Cotton, is appointed to be in full additional charge of the post of Gazetted Assistant, Mungari Cotton Scheme, Adoni, in addition to his own duties Vice Sri. Jagannatha Rao appointed Agricultural Officer, Coorg or until further orders.

2. Sri. D. B. Krishna Rao, B. Sc. (Hons), M. Sc., is appointed as Librarian, Agricultural College, Coimbatore on Rs. 60—6/2—120 in class 23, Madras Central Subordinate Service, with effect from 23rd July 1941.

2. Promotions.

The following promotions of Lower Subordinates are ordered with effect from the dates noted against each:—

From IV grade—Rs. 75--4--95 to III grade Rs. 100.

1. Sri. L. R. Narayana Ayyar, A. A. D. Tirutturaipundi, with effect from 18—9—1940.

2. Sri. M. L. Narayana Reddi, A. A. D. Anakapalli, with effect from 14-5-41.

From V grade—Rs. 45—3—75 to IV grade--Rs. 75--4--95.

1. Sri. S. Venkatarama Ayyar, A. A. D. Mannargudi, with effect from 18—9—1940.

2. Sri. Y. Venkateswara Rao Nayudu, A. A. D. on foreign service as Market-yard Superintendent under the Tobacco Market Committee, Guntur, with effect from 14—5—1941.

2. Transfers.

Name of officers	From	To
Sri. K. Balaji Rao,	A. A. D. Siruguppa,	A. A. D. Adoni.
,, N. K. Thomas,	F. M. Central Farm Coimbatore,	Asst. in Botany, Gudiyattam.
,, T. Paramanandam,	Under the Tobacco Market Cammittee, Guntur,	F. M. Nandyal.
,, M. Vaidyanatha Ayyar,	A. D. (on leave)	A. D. Madakasira.
,, Y. Venkateswara Rao Nayudu,	Under the Tobacco Market Committee, Guntur,	A. A. D. Gudivada.
,, C. S. Sankaranarayana Ayyar,	A. D. Hosur,	A. D. Polur.

„ M. Narayana Ayyar,	A. D. Polur,	A. D. Hosur.
„ D. Panakala Rao,	A. D. Ramachandrapur,	A. D. Tadepalligudam.
„ V. Buchi Raju,	A. D. Chintalapudi,	A. D. Nugru* (E. Godavari Dt.)
„ P. Lakshminarayana,	A. A. D. Chodavaram,	A. F. M. Samalkot.
„ M. V. Narasimha Sastry,	A. F. M. Samalkot,	A. A. D. Chodavaram.
„ G. Sitharama Sastry,	A. D. Gudivada,	A. D. Sathanapalle* (Guntur Dt)
„ T. Rangabrahma Rao Naidu,	Vuyyuru Sugarcane, Growers' Co-operative Union, Vuyyuru,	A. D. Tiruvur* (Kistna Dt)
„ K. Purushotham,	A. D. Hospet,	F. M. Kalahsti
„ T. V. Srinivasacharlu,	A. A. D. Ambasamudram,	A. A. D. Sriperumbudur.

* New sub circle.

3. Leave.

Name of officers	Period of leave.
Sri A. Venkobachari, A., A. D. Harpanahalli,	L. a. p. for 3 months from 1—7—41.
„ Y. Venkateswara Rao, Under the Tobacco Market Committee, Guntur,	L. a. p. for 3 months on m. c. from 22—5—41.
„ B. N. Padmanabha Iyer, A. D. Gingee,	Leave on half average pay for 1 month from 1—7—41.
„ T. Paramanandam, Under Tobacco Market Committee, Guntur,	Extension of l. a. p. for 1 month from 16—6—41.
„ M. A. Balakrishna Ayyar, A. D. Wallajah,	Extension of l. a. p. for 1 month from 6—7—41.
„ B. P. Papaiah, A. A. D. Chintalapudi,	L. a. p. on m. c. for 2 months from 25—5—41.
„ T. Devasikhamani, A. D. Jammalamadugu,	L. a. p. for 30 days from 26—6—41.
„ C. S. Sankaranarayana Ayyar, A. D., on leave,	Extension of l. a. p. for 1 month from 21—6—41.
„ P. Somayajulu, A. D. Salur,	L. a. p. for 40 days from 26 -7—41.
„ S. Venkatarama Ayyar, A. D. Sriperambudur,	L. a. p. for 5 months and 19 days on m. c. from 26—3—41.
„ N. V. Kalyanasundaram. F. M. Kalahasti,	L. a. p. for 3 months from the date of relief,
„ C. C. Balanna, A. D. Allagadda,	L. a. p. for 1 month from 25—7—41.

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EDITORIAL

Agriculture and Industry. From time immemorial, the people of India have been the tillers of the soil. Her valuable raw products were the feeders for many an industrial country such as Great Britain, Germany, America, Italy, France, etc. The war has put a check on her exports for the time being. We have therefore come to think, and there is an unanimity about this all over India, that for a solution out of the difficulty, we have to turn to industries, be it small or great. There is no lack of enthusiasm, no lack of engineering brains and last but not the least, no dearth of capital. Is it not due to Tata that India ever entered on industrial enterprises? When it was so in peace times, is it not imminent that it should be more so during war times. For many an article, say from the safety razor blade to a motor car, which play an important part in our daily life, we are dependent on imports from other countries. Are not these countries which are industrially great also agriculturally advanced? Does agriculture conflict with industry in the West? In the fitness of things, it should not, for, one helps the other. Agriculture and industries are like the different parts of a corporate body in which each has its place and all for the good of the body. We are glad to note that a capitalist has already come forward and started a shipping industry in the Vizagapatam district. For an industry of this kind, plenty of suitable timber is required which is easily procurable in our country as also for an industry like paper manufacture. There are hundreds of industries for which the plant world supplies material and with our large and resourceful forests there should be no difficulty in setting them afloat.

At a time when the Government is engaged in a life and death struggle, it is too much for us to expect them to do the all. Public enthusiasm and patriotism must be roused. The services of the engineers must be easily available to the capitalists. The millionaires of the country must see to the starting of all industries that could be easily started. What Canada and Australia have been able to achieve in a few months must be possible of fulfilment at least in a few years in our country. We will be not only helping ourselves by considerably relieving the problem of unemployment and the disposal of surplus raw plant products but also helping the Government in her struggle now and in the future. All capitalists should gather together and start corporative efforts. A scheme both comprehensive and concentrated should be drawn up.

While so much has been said about industries, let us turn to agriculture and see what can be done there. With the brewing war in the East, rice, the chief food crop part of which is imported from Burma, Indo-China and Siam, is now suffering the worst. This means we have to grow more rice and be self-contained. Every bit of arable land has to be brought under the plough. There is no knowing when conditions which are obtained in other bombarded countries may happen here. So we must take time by the forelock, and be prepared for the worst, though, God forbid, the worst ever being enacted in our soil.

The war has opened our eyes to several things which we have been ignoring so far. Physical strength and health are things that are always desired, more so, during times of war when they have to be exhibited. No nation can afford to set aside the fact that biologically there is in us the instinct of self-protection. It is but natural it should be there. The principle of *Ahimsa* is to be admired when one does not injure another in thought, word or deed. But when one is attacked, is it not his duty to protect himself and those dependent on him? A right understanding of the principle of 'action and inaction' in such matters is necessary. We are now fully alive to the necessity of learning first aid, air raid precautions, etc. To be fit to fight against the enemy and resist his onslaughts health and strength are absolutely necessary. A nation which is physically strong can stand up and face the enemy. That nation which is strong and healthy can also make itself mentally strong. Surely with all that we have inherited from the past, our art, culture, traditions, religion, etc., we do not wish to court annihilation at the hands of Nazi Germany. Let us be up and doing, produce more food and good quality food. It has always been said that a man is according to what he eats. Modern science has taught us what to eat and what not. Cereals rich in protein like wheat, *cholam* and *ragi*, pulses, vegetables especially greens, fruits including nuts, milk and milk products, these should be consumed in larger quantities. The better quality, that is, the nutritive types of food should be made available to every man, woman and child throughout the length and breadth of the country. People fed on good food will form a mighty race. This is the task before the agriculturist youth of the day and he who does it with the true spirit of a missionary will be not only a true patriot but a hero.

The day is not far off when war will be over and peace and order restored and the India after the war will be a mighty agricultural India and an industrial India.

Rabindranath Tagore. With profound sorrow we record the death of Rabindranath on August 7th at Calcutta which marks the end of a long life of service inspired by high ideals, nobly conceived and actively pursued. Born in Calcutta on May 7th, 1861, the poet and seer belonged to a very cultured and religious family. His brothers were versatile and talented, and from birth music and drama were the very air he breathed. In the death of Tagore to quote Mahatma Gandhi "we have not only lost the greatest

poet of the age but an ardent nationalist who was also a humanitarian. There was hardly any public activity on which he has not left the impress of his powerful personality. In Santiniketan and Sriniketan, he has left a legacy to the whole nation, indeed to the world." In Santiniketan, a place of international culture, and world-fame, Rabindranath was the first and foremost to give a rural bias to every kind of education there and we all know that education at Santiniketan is not only varied but extends from the most elementary to the highest grades in each subject. For over fifty years now he has been a great teacher—the *Gurudeva* as he has been lovingly called—of India and of the world, and in the passing away of this mighty soul, India has lost her greatest star which was illuminating not only this country but also the world with a wonderful mixing up of the rich wisdom of the past and of the present. One of his great aims was to bring about a unity between the East and the West and to proclaim to the world that "the ultimate truth in man is not in his intellect or in his possessions; it is in his illumination of mind, in his extension of sympathy across all barriers of caste and colour; in his recognition of the world, not merely as a store house of power, but as a habitation of man's spirit, with its eternal music of beauty and its inner light of the divine presence." The whole world to-day mourns the loss of such a beloved son of all humanity and the Madras Agricultural Journal joins in paying its last tributes to a poet among poets.

Fruit Nursery Practices.*

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It is a well-established fact that the success of fruit-growing industry is mainly dependent upon the fruit nurseries. Nurserymen not only determine the fruit wealth and fruit quality of a region but also influence to a considerable extent the economic condition of fruit farming. A large class of the public naturally look upon the nurserymen for guidance on a variety of matters such as the selection of orchard sites, selection of kinds and varieties of fruits and the proper orchard cultural practices. This aspect of the nurserymen's duties are considered so important in some parts of the world that the issue of periodic publications replying to enquiries and organisation of demonstrations and exhibitions are being done through a permanent and important branch of each of the various leading horticultural nursery establishments. Many countries of the world proudly point out the research work carried out entirely by some of the reputed nursery firms, particularly in the sphere of originating new varieties either by breeding or through selection of bud sports, which form in some fruits a fertile source of improvement, for or through the proper selection of propagating material. Trading with spurious plants under wrong names and with fanciful claims is unfortunately not an unknown feature of the Indian fruit nursery trade. Selection of high-yielding and high-quality parents is done by only a few firms, and even these do not unfortunately enjoy any better patronage from the public than the unscrupulous nurserymen. The mal-practices in trade are given greater prominence than the solicitude for the welfare of the fruit industry. The ignorance of the fruit-growing class as a whole, or the indifference of most of the wealthier classes of growers, many of whom are absentee landlords, have naturally contributed to the present state of affairs. The progressive deterioration in the yield and quality from our commercial orchards is therefore almost entirely attributable to the unscrupulous tactics of some of our nurserymen who, with an eye on quick profits forget the welfare of the industry and the fair name of their own firms. We cannot ignore the fact that some of the reputed nursery firms have in some measure been responsible for the present development. In our own Province it was left to a private firm in Panyam to first popularise the planting of budded citrus trees. Although the present perplexing synonyms are due to the fanciful names given to varieties by nurserymen, it must also be admitted that the extension of orchards under some of the well-known commercial varieties of fruits has so far been largely undertaken by a few

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of the well-known firms or at their instance, particularly in South Kanara, Kurnool, Rajahmundry and Salem. It is therefore necessary for the welfare of the fruit-growing industry and economic improvement of our commercial orcharding demands that our fruit nursery and trade practices should be organised on sound and up-to-date lines. Planting of inherently fruitful trees of high fruit quality and choice marketing value are the basis of success. Although fruit research and fruit industry have been undertaken by the Department of Agriculture rather late, the department realised in the early stage of the inauguration of fruit research that in the production and supply of reliable plants from parent trees of superior commercial value lay the keystone of success. The establishment of two Government nurseries, one at Kodur and the other at Taliparamba formed the evidence of the deep interest the Government took in this matter. These activities of the department formed supplementary to the work already on hand at Coonoor, Kallar and Burliar gardens and at Coimbatore under the scheme for banana improvement. That the nursery schemes initiated by the department have already appealed to the fruit-growing public as a necessary and welcome measure is patent from the large demands for plants from them. At Kodur alone, orders for the supply of over 10,000 plants have been booked in advance during the current year, and in some cases advance orders had to be booked about two years ahead of the expected date of supply. Although the Kodur nursery scheme was put into operation only towards the close of 1939, the financial statement of the scheme as worked out on the 15th January 1941, showed a net profit of 24% to the Government. This is a gratifying feature and has already come to the notice of the public who have started similar ventures of their own at different places in the Presidency adopting *in toto* the nursery practices recommended at Kodur, and employing almost entirely the hands trained at Kodur for propagational purposes. A large number of fruit growers also have themselves undertaken the methods of propagation evolved at Kodur for extending their own orchards. This unexpectedly rapid development within only about $2\frac{1}{2}$ years of the commencement of nursery work at Kodur makes it clear that the public is realising the great havoc that some of the unscrupulous nurserymen have played in the past.

A brief idea of the nursery work that has been and is being carried out at Kodur will not, it is hoped, be without interest to the fruit-growing public and nurserymen. The following account is therefore presented, and it will be seen that it does not in any way indicate that the problem has been dealt with fully. In the farming of fruit crops, the selection of varieties and parents and the evolving of optimum nursery practices form but a few of the several very important items. That of determining the suitable variety for each tract and region and for each purpose, and above all, that of finding out the most suitable and economic rootstock for each variety of commercial fruit are subjects on which any nursery has yet to grope in the dark and has to await results of elaborate and prolonged research. The work of the Government nursery schemes are therefore now limited to only those items, on which

sufficient information is already available. Furthermore, the main purpose at present is to supply plants true to name, of varieties that have already proved their commercial value, propagated from trees which are known to be productive in normal years, and on rootstocks that appear to be suitable.

Citrus Nursery Practice. *Sathgudi* oranges and acid limes which are the most important commercial varieties of citrus grown in Kodur area are propagated by budding on *jamberi* or rough lemon rootstock. *Rough lemon* is believed to be well-suited as a rootstock for almost all commercial types of citrus. It gives a high percentage of germination and a large number of apogamic seedlings. The plant remains in sap-flowing condition for a considerable length of time and the bark peels off easily from the wood, the former feature being conducive to easy bud "take", and the latter feature facilitating budding operations. It is a fast grower, very hardy and gives a straight stem. The seedlings are able to withstand transplantation well. An elaborate trial on nine different rootstocks for *chinee* orange and three for acid limes has been laid out at the Fruit Research Station, Kodur. The data collected so far show that, *jamberi* and *gajanimma* are the most vigorous and produce the largest sized plants. *Jamberi*, however, is preferred in Kodur nurseries because of the aforesaid advantages, and its resistance to gummosis. The scion material is selected from trees of outstanding merit. Some of the leading orchards at Kodur have been surveyed and the trees possessing the desirable qualities have been marked out for taking budwoods.

Sound healthy tree-ripe, rough lemon fruits are selected and seeds extracted. Those that float on water are discarded and heavier ones are collected and sown immediately on raised seed beds of 6 ft. in length and 2 ft. breadth, in straight lines across the beds at a distance of 6 in. from row to row and about $1\frac{1}{2}$ to 2 in. from seed to seed. The seeds are then covered with about two inches of sand. A copious watering is immediately given with rose-cans; subsequently, watering is done daily. When the seedlings are about one month old, a weeding is given, and a month later the weaker and diseased seedlings are pulled out. The beds are daily examined for caterpillars of lemon butterfly from the time of germination of seeds. When the seedlings attain about 6 in. height, they are lifted and transplanted into nursery beds. Generally one irrigation is given to the seed beds a day or two prior to lifting of seedlings.

The nurseries are prepared by giving two or three ploughings and applying a basal dressing of 50 cartloads of well rotten farm yard manure. The beds are generally 30 ft. by 10 ft. in size. Holes are made for planting the seedlings with the nursery transplanters devised at the Fruit Research Station, Kodur. This tool turns out five times the work of a chisel hoe. The seedlings are planted 6 in. apart in rows and $1\frac{1}{2}'$ between rows. Close planting is always resorted to get straight stems. The beds are irrigated immediately after transplanting and again four days later, and continued at regular intervals of 10 to 12 days. Stirring of the

soil between rows with junior and hand hoe and hand weeding in between plants are done occasionally. In order to induce the growth of straight, thick seedlings, the side shoots are nipped off as they emerge. Lemon caterpillars, if any, are regularly hand-picked and destroyed. When seedlings have attained pencil thickness which they do in about a year in nursery beds, they are fit for budding.

Small trials are in progress to study the influence of vigour and kind of seedlings on the future performance of scion. So far no significant differences are observed between the treatments, and therefore, the selection of earlier germinated or vigorous seedlings from seed and nursery beds with the hope of obtaining the best orchard performance, appears futile. Buds are chosen from round, plump wood taken from two-year-old scion shoots which have attained almost the same thickness as that of the rootstock, and which have grey streaks. This wood should be straight and free from angularities. The bud is cut with a very thin slice of wood attached to it. Recent investigations at Kodur have shown that inserting the bud with a thin slice of wood attached to it gives a higher 'take'. An inverted "T" cut is made on the rootstock stem at a height of 6 in. to 9 in. and the bud is inserted carefully with the growing point upwards. Raffia fibre is then tied firmly round the rootstock stem and around the point of bud-insertion, leaving the bud open. From trials with various kinds of wrapping material, raffia fibre is found most suitable as it possesses just the right amount of elasticity to permit the radial growth in rootstocks and bud-sprouts, thus leaving no unseemly constrictions near the bud-joint. When the sprout has made 2 to $2\frac{1}{2}$ in. of growth, the rootstock stem 3 to 4 in. above the bud is lopped off. Observations have shown that although the lopping off of the rootstock stem at the time of budding induces an earlier bud break, it considerably retards the growth of the sprout. Care is taken to remove all rootstock sprouts as they appear. When the bud-sprouts have made a growth of about 4 to 6 in. the rootstock stem is lopped off just above the bud-joint. The optimum season for budding at Kodur has been found to be from July to January. When the bud-sprout has made over 12 in. of new growth, the plant is dug out with a ball of earth of about 6 in. diameter and about 9 in. depth, and then packed in *arika* (*Paspalum scrobiculatum*) straw.

As compared to the period of three years reported to be essential in the Punjab for producing budded orange plants from the date of sowing the seeds, it is found possible to raise similar plants at Kodur within a period of only two years on *jamberi* rootstock. By artificially stimulating the growth of seedling rootstocks in seed and nursery beds, it is possible to further reduce this total period of two years by about three months. It seems clear that soil and climatic conditions influence the length of the pre-orchard life to a considerable extent, and this, specially the absence of a prolonged dormant season associated with severe winter conditions is possibly the explanation for the very great advantage that Kodur enjoys

over some other important citrus tracts in India as the Punjab. This feature has been emphasised by other workers also who have pointed out that in some parts of the tropics the pre-orchard period of citrus budded plants from the time of budding to that of planting out in the grove is only about eight months as compared to 12 to 24 months under semi-arid conditions as in South Africa and California. Experience at Kodur has, however, shown that a well-formed tree can be grown in nursery in about five months from budding, if the operation is done in proper season and on a suitable rootstock.

Mango Nursery Practices. Since seedlings of most of our mangoes do not breed true to type, vegetative methods of propagation have to be resorted to, to continue the desired parental characters. Inarching has been the commonest method of mango propagation in India. There are some varieties of mangoes which give rise to more than one seedling per seed, only one of which is sexually produced while the others are apogamic. The value of employing these apogamic seedlings as rootstocks with *baneshan* and *neelum* as scion varieties is in progress at the Fruit Research Staiion, Kodur.

Stones for propagation of rootstock seedlings are chosen from productive and vigorous seedling trees. They are sown soon after extraction, in beds at a depth of about 2 in. and with a spacing of 6 in. from seed to seed and 3 ft. from row to row. Sowing with the plumule up has been found to produce straight tap root and stem, both of which characters facilitate inarching operation. Shelled stones produce seedlings with straighter tap root and stem than unshelled ones, but the practice is not followed at Kodur as it is expensive and the percentage of germination low. Grading of fruits or stones is not considered a necessary operation in mango nursery practice, as neither plant vigour nor germination is found to be dependent on these.

When the plants are one-year old, they are lifted with a ball of earth and potted. Heavy defoliation 7 to 9 days prior to lifting from seed beds has been found to be advantageous. The tap root is pruned while potting the seedlings. The pots are watered soon after potting. Placing the potted seedlings close together in a trench and letting in irrigation water thereafter at an interval of 4—5 days is shown to be a more economic practice than the prevalent system of hand-watering the pots daily. The rootstock seedlings get ready for grafting within 12 to 15 months, when they attain the thickness of a pencil. Inarching on seedlings of even 4½ months of age is found possible, but this is not being done as the demand for such small plants does not exist in this Presidency. An experiment to determine, if older rootstocks are to be preferred to younger ones for securing the best tree performance, is under way at Kodur. So far within a period of three years no significant difference in growth between the younger and older rootstocks is found. Scion shoots of the required variety are taken from trees possessing such qualities as heavy bearing tendencies and good fruit

quality. The trees should not be too old or weak or diseased. The method of inarching is too well-known to be described in this paper in any detail.

The separation of the graft from the parent tree by lopping off the rootstock portion above the graft-joint is done in stages. The optimum period from the date of inarching to that of separation from scion parent is found to be about three months but some varieties like *rumani* demand a longer period. The optimum season for grafting under Kodur conditions has been found to be July to September. A number of trials have also shown the commercial possibility of raising mangoes by side-grafting and budding. It is possible to plant out the grafts immediately after separation from scion parent if favourable weather conditions prevail. However, in order to avoid casualities, the grafts are kept in shade for about a month before being despatched or planted out.

Propagation of other Fruits. Propagation of some of the best varieties of guavas, sapotas, pomegranates and grapevines available at the station has also been undertaken. The first two are propagated by layering and the last two by cutting. These methods are also sufficiently known to need any elaborate description. Grafting of sapctas is proposed to be undertaken shortly.

General Remarks on Nursery Trade. One of the greatest set backs to fruit industry received from unscrupulous nursery practices is in the matter of wide-spread supply of inherently unfruitful trees and plants of varieties unsuited for commercial cultivation. Some kind of control on the private nursery trade to prevent the supply of such uneconomic plants shall have to be devised if the fruit industry has to be placed on a sound economic footing. A system of registration of private nurseries on a voluntary basis, or the introduction of suitable legislative measures may have to be brought into being to achieve the desired change. From the point of view of the public also, there is a widespread and legitimate grievance that a very large number of plants purchased by them suffer serious damages in transit, sometimes leading to a high number of casualities. This is a matter on which the nurseries cannot be legitimately blamed, as the safety of plants consigned to the care of transportation authorities is beyond the control of the consigners. At the same time, it would not be fair to expect the public to bear the cost of such dead or damaged plants for no fault of theirs. The only possible remedy lies in the railway authorities undertaking to cover such risks, particularly in so far as the damage due to rough handling and undue exposure to adverse weather conditions are concerned. A system of undertaking the delivery of plants to consignees immediately on arrival at the consignees' railway stations would also go a long way to minimise the loss.

Some Fruit-tree Diseases in Relation to Horticultural Practices and Mineral Deficiencies.*

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In combating plant diseases the most desirable and the least expensive means lie more in the line of prevention than in that of treatment. In fact, preventive methods are the only means effectively employed in certain diseases. Effectiveness of the method and the expense involved are the two criteria to be reckoned with when any of them are to be advocated either for prevention or for cure or when their suitability is to be assessed.

In the domain of horticulture it is a well recognised fact that healthy and productive orchards are mainly dependent upon the care and attention bestowed by the growers to each and every orchard or nursery practice with an eye not merely on the future growth and productivity but also on the freedom of trees from pests and diseases. The incidence of a host of diseases can be accentuated to as great a degree by an ill-devised or badly executed orchard practice as the insurance of the health of the orchard can be effectively done through proper cultural methods. Countless orchards have been ruined irreparably by a thoughtless orchard practice; and the tragedy in these is all the more acute because the growers have not usually any scope left to rejuvenate the damaged trees or make them regain their normal vitality. Loss of the entire crop in one season due to a severe pruning of root or shoot in an adverse season is but one of the instances to the point. Much loss from diseases and pests starts in the seed and nursery beds and continues to mount up as the orchards grow. Poor drainage, improper application of water, excessive shading, too great a humidity and over-crowding in seed beds are factors most congenial to the incidence of 'damping off' and other allied diseases. Sowing healthy and mature seed on raised beds of good soil texture with sufficient spacing is the simplest method of creating healthy and beneficial growth conditions for the seedlings and preventing them from susceptibility to such seed bed infestations. It is very gratifying to note that at least a few of our private nurserymen have realised the effectiveness of these methods instead of trying to combat the diseases at a later stage by resorting to curative treatments entailing unnecessary expenditure. Planting the seedlings too far apart to permit of animal power interculture, frequent interculture in nursery beds resulting in an injury to roots, heavy organic manuring and indiscriminate watering are some of the prevalent practices to be thoroughly discouraged, as each of them has the effect of rendering the nursery stock predisposed to fungal attack or nutritional disorder through root injury and through frequent inhibition of growth activity. As a good nursery is the foundation of the

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future orchard any precautions taken at this stage have undoubtedly a profound bearing on the future prosperity of the plantations.

Everything else being favourable, fruit trees adapt themselves to a wide range of soil types, but marked differences in their rate of growth and power of resistance to diseases and pests are easily perceptible. However, mango and citrus orchards raised on soils of poor fertility, or on ill-drained soil or sub-soil conditions and alkaline in reaction, or on those with a relatively high percentage of soluble salts are predisposed to diseases like 'wither tip', 'die-back' and various kinds of root and bark rots after a short period of apparently luxuriant vegetative growth. Opening up sub-soil drains and such other soil curative methods may alleviate the trouble to a certain extent, but it would be far better if the growers exercise more care in the selection of the site for the plantations than depend on the improvement of soil at a later stage. In and around Bezwada, acres of orchards planted to *Vadlapudi* and *Batavian* oranges have been ruined owing to the prevalence of various kinds of root and bark diseases which still continue to assume very serious and disquieting proportions. Prolonged water stagnation in these stiff soils partly as a result of the prevalent defective practices of irrigation and culture rendered the problem of combating the diseases more complicated. The obvious line of successful approach to the problem would seem to lie in propagation of these oranges on root-stocks resistant to these diseases under such conditions. Limes which are known to thrive exceptionally well even under such adverse conditions may provide very useful root-stock material.

Selection of economic varieties and of inherently high yielding trees form the very basis of remunerative orcharding. Therefore only those of outstanding performance and quality resistant to diseases and pests common to the tract should be propagated. The safest method would be to propagate buds or grafts from trees showing the least tendency for marked variations in fruit and leaf characters and also such of the strains within the varieties indicating marked disease resistant qualities. While no uniformity exists at present in the selection of suitable rootstocks, rough lemon (*Citrus jamberi*) for oranges has been the most popular rootstock in use, as it is believed to possess resistance to stem and root diseases besides a rapid rate of growth. A nurseryman eager to produce big sized plants to meet the fancy of the purchaser may prefer the indigenous *gajanimma*, which is of exceptionally quick growing habit; but the purchaser of oranges on this rootstock does not take long to find out the extreme susceptibility of this plant to *gummosis*, a disease so virulent that often it baffles the ingenuity of the pathologists to control. An elaborate trial of nine different rootstocks for oranges and three for limes to test the relative merits of each of these is in progress at the Fruit Research Station, Kodur, and may be expected to yield in due course very useful results from a practical standpoint, both in regard to selection of the most paying rootstocks as well as in the views of disease resistance. Such trials when conducted under the diverse conditions prevalent in this Presidency will furnish the requisite information

to the fruit growers in every tract, and thus enable them to avoid the pitfalls from the injudicious selection of rootstocks.

Budding and grafting when extremely dry or wet weather prevails, or on crooked and old rootstocks making too wide or deep incisions on the rootstocks and propagating with buds from wood of disproportionate size rendering the region of the joint very vulnerable to the retention of moisture for unduly long periods, consequently providing a good nidus for the development of parasitic and saprophytic fungi are a few of the numerous undesirable practices in our nurseries which require to be discontinued. Incompatibility in the rates of growth of scion and stock results in either a smothering of the scion sprout or a too rapid growth of the stock and defective union, leading ultimately to a disturbance in the essential balance, rendering such plants easily susceptible to parasitic and non-parasitic influences. Early lopping of the stock or propagating on very old rootstocks merely to cope with the growing demand for big-sized plants, or again, lifting trees for immediate despatch in an active growing condition without preliminary hardening are all measures which tend to raise the percentage of mortality. Unskilled grafting and budding resulting in unsightly constructions at the joints, or forcing growth inordinately under artificial shade and pot-house conditions just to satisfy the consumers' demands are yet other prevalent nursery practices to be thoroughly discountenanced.

Under orchard conditions also there are a host of practices which are of prime importance in determining the future health of the plantations. Planting out trees during seasons of extreme heat or humidity, planting them too close as to hamper free root spread and preventing sunlight from ever reaching the lower branches of trees after they have grown up resulting in a dislocation of their photosynthetic activity, or planting them too low as to permit irrigation water coming in direct contact with the trunk and the bud or graft-joint all have harmful repurcussions on the future health and vitality of young plants, and therefore are to be avoided. Undue and unnecessary mechanical injury to the root and trunk portions during planting or exposing them too long to the sun and drying winds prior to planting also tend to increase the chances of fungal infection and are therefore undesirable.

Irrigation to plants, young and old, are given generally at predetermined or spasmodic intervals. Flood irrigation wherein water is inevitably allowed to get into direct contact with the trunk and remain as such for long periods, mounding up earth round tree trunks or making miniature basins too narrow to serve any useful purpose or surface wetting at too frequent intervals are some of the most injurious practices now prevailing. Thorough and soaking irrigations given at long intervals after determining the extent of soil moisture by rough tests, and widening tree basins so as to encompass the entire root-zone of absorption with a gentle slope towards the extremities would prove very effective in preventing the occurrence of root and collar rots.

Applications of disproportionate quantities of artificial fertilisers to the complete exclusion or a meagre dole out of bulky organic manures tend to encourage plethoric activity in plants to the detriment of flowering and fruiting, besides bringing about various nutritional and physiological disorders. Manuring young plants too heavily or at the time of planting are also attended with disappointing results.

It would apparently seem incredible, but is yet a verifiable fact that in some of the orchards, in an anxiety to ensure some quick returns, alleys of fruit trees have been used for raising crops like paddy and cholam or fruit crops like bananas. Besides proving very serious competitors to the main trees for plant foods, any cultural treatments given to these intercrops are bound to influence adversely the health and vigour of the main plantation. Instead, growing and ploughing in green manure crops would enhance the fertility of the soil.

Pruning is so much more of a science than mere art that most growers with whom it merely consists in drastic stubbing back of trees during periods of active growth and exposing the wounds have reaped too often only disastrous results. Severe and repeated root pruning at all stages of growth and in all seasons indiscriminately to force off-season crops tones down the trees rendering them susceptible to pathological infestations. Pruning trees to shape and training them to fruit in the lower branches facilitating easy harvest and preventing sun burn of fruits is no doubt a commendable practice if resorted to with a full sense of descrimination.

Harvests should be done with a great deal of care for the reason that, carelessness will result in bruises and abrasions of the skin which admit the germs of decay. Picking fruits with the stalks intact but cut back to the level of the skin, would ensure a reasonable measure of safety against inroads by fungi. Dumping fruits after harvest in odd ill-ventilated corners would also mean inviting various kinds of storage and fruit rots.

From the foregoing, the conclusion would seem indisputable that at every stage of orchard management, ignorance or indifference brings into operation a series of factors most congenial to the incidence and multiplication of various pathological disorders. It would seem very appropriate therefore to expect that a detailed and sustained study of the relationship that undoubtedly exists between horticultural practices and the incidence and severity of diseases and pests would open up new vistas of very useful and fruitful research. As Kodur is the natural centre of investigation on the cultural aspects of tropical and sub-tropical fruits, situated as it is in the heart of an important fruit producing region, and capable of providing a wealth of material for research, a wing in plant pathology opened in collaboration with the pathologists at Coimbatore would satisfy the most pressing need and render it most up-to-date and eminently modern from all points of view.

More hazardous but obviously less realised by orchardists are the effects of nutritional disorders on the prosperity of fruit trees. While the prevention of these depends also to a considerable extent on the proper

selection of varieties, rootstocks, soils and environmental conditions and to a certain extent also on the orchard cultural practices, these disorders are more difficult to be understood and diagnosed by the average growers.

In the numerous literature on the deficiency disease of various kinds of fruits that has steadily accumulated during the past quarter of this century, the symptoms of diseases caused by each and every important element in the soil has been described with a wealth of detail in respect of most of the commercial fruits in different parts of the world. The preventive and control measures have also been indicated for each malady, and among the several devices employed, tree injections, sprays and soil applications with elements or compounds diagnosed as deficient in the tree or soil, insertions of the same within the bark and painting the pruning wounds are the most noteworthy.

By far the most baffling disease very commonly met with in almost all citrus orchards is a condition of partial chlorosis known as 'mottle-leaf' or 'frenching'. Though the disease gets its name from its effect on the leaves, in severe cases, the tree and fruit size are adversely affected. The leaves show chlorotic areas, irregular in outline between the veins of the leaves. Each yellow area arises as a spot which widens and turns deep yellow, the tissues over the mid-rib and veins retaining their chlorophyll even in advanced stages in most cases. This green tissue gradually fades into the yellow interveinous patches. In severe cases leaves do not attain their full size but are narrow, rosetting at the apex of the twigs, the trees stunting and branching densely as the twigs die back. The disease occurs on a variety of soil types including light, sandy and heavy loams. The relationship between soil type and incidence of mottle-leaf has been found very complex to determine. It may, however, be safely stated with the existing knowledge that deficiency of zinc is one of the immediate and primary causes of mottling in citrus though qualified by several others mainly contributory in effect. In the case of many fruit trees the incidence of several kinds of mottling has also been traced to elements other than zinc such as iron, boron, manganese, barium, strontium, vanadium, lithium, and such other minor elements and in some cases to the absence of important manurial elements like nitrogen, potassium, phosphorus and lime.

Control of mottle leaf in citrus has been sought as in other deficiency diseases by the use of a large number of compounds. At the Fruit Research Station, Kodur, trials of an observational nature to test the efficacy of compounds like sulphates of copper, iron, zinc and manganese, and boric acid in the control of mottle-leaf through soil application have been underway since an year. The necessity for these investigations arose by the fact that spraying the mottled trees with zinc sulphate and lime which for sometime held the field in the Kodur orange area as the most efficacious curative treatment did not always result in regaining the normal health of affected trees. Even in some cases where the recovery was almost immediate and spectacular the beneficial effects were found to be transitory and inconsistent. Small amounts of several compounds, well powdered, varying in

doses from two to eight oz. by weight were therefore deposited in crowbar holes made all round the trees about two feet away from the trunk and covered up before irrigation. Of the trees applied with 4 to 8 oz. doses of zinc sulphate nearly 80% have responded very well within periods varying from a month to three months of application. Majority of these trees had previously failed to respond to zinc sulphate spray. Boric acid and ferrous sulphate have also shown a high percentage of response but the population on which these were tried is too small as yet to justify any rapid conclusions being drawn as to their relative merits in the control of mottle-leaf, but nevertheless indicate very useful means of approach to the problem. Copper sulphate, manganese sulphate and lime failed to show any beneficial response even on the small population tried, and may possibly be ruled out after a further period of trial as ineffective. In no case has any toxic effect of the compounds applied been traced upto this period.

Data collected to correlate the incidence of the disease with the rootstocks on which orange varieties have been propagated at this station seem to indicate the easy susceptibility of *kichili* and *gajanimma* rootstocks, the extent of incidence ranging from 12 to 17 per cent. of the total number of trees affected by mottle-leaf. Pomelo and sour orange appeared more resistant with only 2 to 6 per cent. infection. Details as to varietal susceptibility and factors affecting the severity of the disease are also being gathered, but it would seem justifiable to indicate at this stage that while lemons and limes of all varieties are practically free from the disease, *santras* and to a much lesser extent sweet oranges show a predisposition to this disorder.

It would, therefore, seem reasonable to conclude from these observations that application of zinc sulphate to soil, preferably in the earlier stages, is full of promise as an effective control measure of mottle leaf under Kodur orchard conditions. Its cheapness, simplicity of procedure and effectiveness should make an appeal to every fruit grower of this tract and elsewhere as one of the safest and simplest of means available for controlling this baffling disease. It is not, however, reasonable to expect spectacular results at very advanced stages of the disease. And one need not be too often reminded of the wisdom in the age-old adage that 'prevention is better than cure'.

From a consideration of the facts presented in this paper it must be very evident that co-ordinated research on all aspects of fruit culture and the pathological problems associated with them made available to the fruit growers would be of immense practical value.

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SELECTED ARTICLE

Plant Breeding and Genetical Work in India.*

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I. Introduction.

The President of this section last year made a departure from the usual custom of confining the address to a branch of the subject he was most familiar with and gave instead an address on a general review of the progress of agriculture. I shall, however, revert to the usual practice. Last year's address had a large portion of it devoted to the value and care of seed. It is probably in the fitness of things that my address deals with the problem of search fo·, and production of seed with inherent superior characteristics. I shall make a general survey of the plant breeding and genetical work in India and in doing so, refer largely to two crops, rice and cotton, with which I am most familiar.

Scientific breeding with crop plants has become a powerful and indispensable tool for making agriculture more efficient and more flexible in meeting new demands and supplying the needs of men for food and raw material. "In the realm of living things with which agriculture deals, the work of the breeder is comparable to the work of the inventor in the realm of inanimate things, with which industry deals, and his work pays in the same way that invention pays by replacing continuously the old by the new or making possible what was not possible before". The growing of improved types involves no additional expense to the cultivator and the work of breeding improved types has formed an important plank in the activities of the agricultural departments right from the very beginning.

Plant breeding in its strict sense means the production of better crops, the ultimate test of superiority, with exceptions, being greater yield per unit area and hence greater return to the grower. In the case of industrial crops like cotton, besides yield, the question of quality also comes into consideration in deciding the return per acre and hence breeding for quality does form part of the breeder's objective. At the present time breeding for quality in cotton has become an urgent necessity in several tracts since the bulk of the cotton produced in India is of short staple, the outside market for which has considerably dwindled. Breeding for quality in food crops, cereals, is still not of much importance in our country as the term 'quality' is incapable of a precise definition and usually has no bearing on the nutritive value. To mention only one example, the quality in rice, as is commonly understood, depends upon the size and colour of the grain and upon the extent of polishing it has received. Quality from the nutritional point of view is, however, quite different and if practical effect is to be given to the findings of research work on this problem, (Ramiah *et al.*, 1939) we shall have to radically change our ideas about quality in this most important food crop of the country.

Even in industrial crops, for various reasons beyond the control of the grower, yield under Indian conditions still forms the predominant factor. Let me try to illustrate this with a small example in cotton. The local indigenous cotton grown in Central India is of a poor quality, the lint capable of spinning only 10—12 counts. There is, however, the Upland cotton, which is definitely superior to the indigenous in quality and commands a better price in the local market but does not yield quite so well as the indigenous as a rain-fed crop.

* Presidential Address, Agricultural Section, at the 28th Indian Science Congress, Benares, January 1941.

Examination of extensive data on spinning quality and market price for cotton (Panse, 1940*c*) has brought out the fact that the premium obtained for the superior quality of Upland cotton can compensate only a ten per cent. reduction in yield while field trials have shown that the reduction in yield by substituting indigenous cotton with Upland is much greater than this figure, and hence it is not profitable to grow Upland cotton in Central India on rain-fed land.

II. A Survey of Plant Breeding Results.

i. *Results of plant breeding.* Scientific plant breeding, which is not more than thirty years old in India, has been carried on along the traditional lines of selection, introduction and hybridization. In fact, the methods followed are the same that have been followed in the West and the principles involved, which are fundamental, are applicable to all plants in general. It may be worth while at this stage to take stock of the practical results that have emerged so far from this plant breeding work. The only measure of success of this work is the total area occupied by the improved types in various parts of the country Taking India as a whole, the total area under the four important crops and the area devoted to the improved types evolved by the Departments of Agriculture are given below for the year 1937—38.

Crop.	Total area (acres) under the crop, (*thousands*).	Area (acres) devoted to improved strains, (*thousands*).	Percentage.
Rice	72,277	3,759	5·2
Wheat	35,618	6,930	19·5
Cotton	25,583	5,672	22·2
Sugarcane ...	3,818	2,855	74·8

The area under the improved types of sugarcane is very striking because the superiority of these types over the local, which these have replaced, has been phenomenal. In fact, the benefit that the country has gained by the results of plant breeding in this one crop, which can be valued in several crores of rupees has become a classical example of plant breeding achievement, the credit for which goes, in a large measure, to one of our own members and an ex-President of the Congress, Rao Bahadur T. S. Venkataraman. It may be mentioned in this connection that the protection given to this crop has been an important contributory cause for the rapid spread of improved types of sugarcane. That the area under improved types in other crops is not so striking is due to various causes. For one thing, except in the case of cotton and sugarcane, it is so difficult to estimate with any degree of accuracy the area under the improved types, the figures given above, being only rough approximations. Though the percentage area under improved varieties of rice is not considerable taking the country as a whole, it is certainly very much higher in individual Provinces like Madras and Bengal where plant breeding has been carried on in this crop for a considerably longer period than in other Provinces.

ii. *Spread of improved types.* Botanists working in the departments of agriculture might produce better types of crops by breeding, but owing to the peculiar conditions in which Indian Agriculture is carried on, small and scattered holdings, the special tenancy systems, financial instability of the grower, the necessity to sell the produce with the seed as in cotton, etc., it is almost impossible for every individual cultivator to multiply his own seed from the improved types and an organization is necessary to make such seed available to the cultivator. The extent of such organization varies in different Provinces and States in India. While some Provinces like the Punjab spend several lakhs of rupees

every year in the multiplication and distribution of seed of improved varieties, there is hardly any expenditure under this item in some other Provinces. It must be mentioned here that the amount involved is not a gross expenditure to Government, but only represents a sum invested and later recouped by the sale of the seed. Owing to sudden fluctuations in the market prices, particularly in industrial crops, it is possible there may be a small loss incurred, in certain seasons, but, considering the practical benefit realized, the loss, even if there should be any, can be safely ignored. In the case of cotton, the Indian Central Cotton Committee finances several seed distribution schemes in different Provinces and States. Because of the limited funds at the disposal of the Imperial Council of Agricultural Research, they were mainly concerned with financing research schemes and now that the resources of this body are likely to be augmented, it is up to them to see whether they should not initiate and partly finance seed distribution schemes also in cases where such help should prove necessary and useful.

We cannot, unfortunately, compare ourselves with countries in the West on this question. There, the multiplication of improved types of crops and making them available to the cultivator is carried out by professional seedsmen as a business. In fact, in countries like Denmark and Sweden, the seedsmen themselves do the work of breeding superior types. Most of the advanced countries have also Seed Acts in force prohibiting growers from using seed which is not pure and certified. The only non official organization that might take up this work is special Co-operative Societies and although a certain amount of such work is being done in India, the output forms an infinitesimal proportion of the total requirements.

Any increase in yield which does not come up to ten per cent is rather difficult to be appreciated by the cultivators and in fact, this is the minimum figure aimed at by most plant breeders under ordinary methods of cultivation. In several cases, the improvement claimed by the breeder as a result of extensive trials, is much above this figure. It is generally the experience of plant breeders that improved types respond very much better than the unselected types to more intensive methods of cultivation.

Of the four crops mentioned above, dropping out sugarcane where the area under improved types is very high and has hence markedly increased the output in the country, the question may be raised whether on account of growing improved types in other crops, the output of the country has been perceptibly increased. Persons who do not believe that much benefit has occurred from plant breeding work often compare the standard yields of crops per acre as published in the crop statistics of India with those of other countries to support their case. In the case of rice crop, for instance, the average acre yield in India, which is 825 lbs. in 1937-38, is about one-third to one-fifth of yields obtained in Spain, Italy and Japan. Similarly, the average acre yield of cotton crop in India is 89 lbs. of lint as compared to 267 lbs. and 531 lbs. respectively in America and Egypt. It is hardly realized, however, that India is a big continent with very divergent climatic conditions and rainfall as compared to countries which register high yields and the total area under the crop in these countries is comparatively small. It will be hardly legitimate to make such a general comparison between countries. So far as can be seen from the published records and from personal knowledge of some important plant breeding centres in the West, the actual increase in *yield* as a result of plant breeding is generally never higher than 20 per cent. This is the figure that has been declared as a workable limit for rice breeding in Japan. If Indian acre yields are still low, the reasons have to be sought elsewhere. India is an old country and manuring is never practised. The increased yields of strains are marked by the comparatively

smaller areas devoted to them. In regions where strains are grown on a larger scale, protected by irrigation and sometimes fertilized, very much larger acre yields are recorded, as for example, Co. 2 cotton tract of Coimbatore and deltaic rice tracts of Madras. In Egypt, cotton yields are high due to irrigation, heavy manuring and silty soils and in America to manuring, virgin soils and protection against erosion. In certain rice areas of Madras where suitable conditions exist, it has been possible to demonstrate that by the growing of improved strains combined with intensive methods of culture, the acre yields can be increased to 3,000—4,000 lbs. per acre, comparable to yields obtained in Japan. I am confident that plant breeding work in India, both from the standard of work and the results achieved, is quite comparable to similar work done in more advanced countries of the West or East.

iii. *Need for improved agricultural statistics.* In this connection it may be useful to raise the question of the average yields of crops as published in crop statistics. What is the basis of these figures? It is only recently that this question is being examined. Even in the case of cotton where, due to the cotton cess, it is possible to estimate fairly accurately the total output of the country, the figure arrived at by this method differs from the figure given in the statistical reports by over 30 per cent. In the case of other crops, some tests made in isolated centres have shown that the figures vary from those of the statistical reports very considerably. Even the recording of the area under any particular crop has been found to be inaccurate. So far as can be ascertained, the figures of the statistical reports are not of much value. It is a good thing that the Imperial Council of Agricultural Research have taken up the problem of determining standard yields in wheat and rice. A similar investigation is being started for cotton also. Granting that the production is certainly higher than what is stated to be, such increased production should be reflected in a greater well-being of the cultivator, and the question may be asked whether there is any indication to that effect. There is, however, one thing to be mentioned in this connection, namely, that the population of the country has also considerably increased and there are probably other considerations which may be pertinent though beyond the scope of this discussion.

III. Methods of Breeding.

The principles and technique of plant breeding may be briefly described here. Of the three methods mentioned earlier, namely, selection, introduction and hybridization, introduction may probably be left out though there are instances, almost historical, on record, of introduced superior types from one region to another proving a phenomenal success. Such successes are more an exception than a rule, since it is within the experience of plant breeders that the great range of agricultural and climatic conditions under which a particular crop is grown in different parts of the country has resulted in special local adaptations which naturally limit the scope of such introductions. We can consider the other two methods in greater detail.

i. *Selection in natural population.* In the tropics, the plant material has not received the intensive study which has been applied to the temperate crops before the ideas of pure lines and Mendelism were brought to bear on the problem. Every crop presents a mixture of types. Sometimes there may be a dominance of one particular type which may amount almost to a condition of purity, but there is enough evidence that such approximation to purity has risen by the suppression of other types by natural agency. The type best adapted to the prevailing conditions survived, but where adaptation for more than one type is sufficiently close, a mixture of types forms the crop. Selection in such material is nothing but exploitation of the naturally existing variability. Have

we any methods to say which primary selections in the variable material would give the desired result? The answer to such a question is, so far as we know, No, and this is the main reason for considering plant breeding as more an art than a science. Intimate familiarity with the crop and the scale on which the selections are made and studied are often the deciding factors in the attainment of success in the method. There is no known method of discriminating the important environmental influence on the crop and the testing of the progenies in replicated and randomized plots is the only criterion to go by. The larger the number of initial selections handled, the greater are the chances of getting a useful type, and for the elimination of undesirable types at the initial stages, the breeder has still to depend upon his visual observations Although due to the recent advances in statistics as applied to agriculture, designs have been evolved to test even a very large number of initial selections in a replicated experiment, (the incomplete randomized blocks and modifications of the design), still, elimination of a certain number of initial selections without actually bringing them under replicated trials cannot be avoided. Usually the initial yield trials carried out by the plant breeder in smaller plots are later extended to trials in bigger plots under cultivators' conditions in various parts of the tract and the best selection as determined by these series of trials is multiplied and made available for distribution to the cultivators. It has been the experience of the more successful plant breeders that it is not necessary to wait for commencing the district trials until the small scale trials are actually finished, but to carry on the two trials simultaneously in the later stages. Thanks to the work of the statisticians, the technique of carrying out the trials has been very much simplified and reduced to a routine. This is in brief the method followed in the selection technique in cereals, rice, wheat, *jowar*, etc. These crops are almost entirely self-fertilized and the initial selection is itself assumed to result in isolating several pure lines and all further work is directed towards determining the best among the several pure lines.

When once pure lines have been established, secondary selection is not usually practised in these crops. It was once tried in rice in Coimbatore to see if there was still genetic variability in one of the established pure lines. Yield was the only criterion that was taken into consideration as there was no morphological variability in the material. Since the variations in yield observed were within the limits of experimental error, it was concluded that it was not worth making secondary selections in this crop. There are not many records of systematic secondary selection being practised in the cereals and even the few cases mentioned have been carried out more from the point of view of characters than of yield. In cotton on the other hand, secondary selection has always been practised by breeders though, as has been pointed out by Mason (1938), the effect of such secondary selection has been in most cases only of a small advantage while the main improvement has been realized in the primary selection. Such secondary selection has been, until very recently, mainly towards making the selection homozygous, i. e. reducing the genetic variability. In cereals, while once a selection is morphologically pure and also reasonably pure for economic characters like duration, height of plant, size of grain, etc., the only point for consideration was yield. In the case of cotton, however, though yield continues to be the main consideration, attention is devoted to two other important characters, namely, length of the fibre and the ginning percentage. These two quantitative characters, to be mentioned again later, are controlled by a number of Mendelian factors and it is impossible to get absolute homozygosis for these characters even after several generations of selfing. Secondary selection has been mainly directed to reduce the heterozygosity in

these two characters to the minimum, and carry forward such of these selections as are apparently pure.

It will be seen from the above that the main principle of selection, namely, exploitation of the naturally existing genetic variability, is not lost sight of in the case of making secondary selection. Hutchinson and Panse (1937*b*) have found out that environmental effects contribute so much to the variability of the breeding material that genetic effects remain undetected by the usual method of progeny-row method and have improved the technique enabling comparison to be made of genetic effects freed from environmental disturbances. The principle of secondary selection is based on the existence of genetical variability, and the attempt of the plant breeder should be to obtain a progressive improvement in his material by the isolation of superior types arising by segregation in the progeny of initially heterozygous selections The new replicated progeny-row technique developed by them helps the breeder to divide the best of his material into two lots, one in which further selection is likely to be profitable, and that which has reached the limit and may be passed on from the breeding to the testing plots. The technique has been used successfully in cotton breeding in Indore and a type with a better quality has been evolved from strain that was considered under the previously known methods of breeding to be already fixed for that character. In addition to improvements in yield, this technique has also proved highly useful in developing cotton selections showing high field resistance to the *fusarium* wilt. From material which showed a mean field mortality of 60 per cent, due to wilt, strains have been obtained with less than 10 per cent. mortality.

While the value of this improved technique has been definitely demonstrated in the case of cotton, the question remains whether it would be worth applying it to other crops, particularly, the self-fertilized cereals. An attempt was made to use the method in the selection experiments going on at the Indore Institute on *jowar* and linseed. The data so far available have definitely shown that, while there was no sign of progressive improvement in yield by such secondary selection, genetic variability in lodging of straw in *jowar* and in resistance to wilt in linseed was demonstrated.

ii, *Selection in hybrid population.* We then come to the question of plant breeding by hybridization. When we find that simple selection is not yielding any material of value, it means that there is no genetic variability to select from, and the only recourse left is to resort to hybridization between varieties so that genetic variability would have been produced to give scope for selection again. Although plant breeders did carry on crossing among varieties even in earlier days, the scientific background for the work was provided by the rediscovery of Mendel's Laws in 1900 and which is now a highly developed science under the name of Genetics. Mendelian principles of heredity are so well known that I need not deal with them here. The science of Genetics has been of great value to the plant breeder in that it has given him a clearer conception of his problems and a better understanding of the process involved in his work. When Mendelism was first brought to light, great hopes were entertained of combining into one plant various attributes coming from different parents. Whether the practical results obtained in economic plant breeding since the advent of Mendelism have been commensurate with these hopes, there are differences of opinion. The main aim of economic plant breeding is to get greater yields. Using this as the criterion, it is probably a safe assertion to make that the influence of the science of genetics has been much less profound on the art of plant breeding than was expected by the early genetics. There is, however, one aspect of the genetical knowledge which has produced profound results.

The knowledge that physiological characters like resistance to diseases, cold, etc., are also inherited in the same way as other characters have led to the classical triumphs of Prof. Biffen in producing rust resistant wheats and of Prof. Nilsson-Ehle in producing winter resistant wheats and barleys. Even in India this aspect of plant breeding plays an important part and conspicuous successes have been obtained. We need mention only as examples the wilt resistant *arhar* of Pusa, wilt resistant cotton of Bombay, and blast resistant rice of Madras.

A reference to the annual reports of the Provincial and Imperial Departments of Agriculture in India would give an idea of the number of improved types that have been evolved by plant breeding and it is not necessary to give a list of them here. It may, however, be worth mentioning some of the most outstanding ones which are now under cultivation very extensively.

Selections in natural populations:—

Rice	...	GEB. 24 of Madras.
		Indrasail of Bengal.
Wheat	...	Number 4 and 12 of Pusa.
		8A of the Punjab.
Cotton	...	Co. 2 of Madras.
		V. 434 of Central Provinces.
		P. 289F of the Punjab.
		Sind Sudhar of Sind.

Selections in hybrid populations:—

Wheat	...	Pusa 52.
		C. 518 and C. 591 of the Punjab.
Cotton	...	1027 A. L. F. and Jayawant of Bombay.
Sugarcane	...	Several Coimbatore types like Co. 213, Co. 281, Co. 290, and Co. 419.

iii. *Mixture or Pure strains.* The question of the utility of growing a mixture of types rather than a single type may be considered. The idea might appear unscientific to persons accustomed to orthodox views of pure lines, homozygosity, etc. Still it will be evident from what follows that the problem deserves consideration. There has been experimental evidence available with plant breeders to show that a mixture of types grown as such, gives a greater yield than the components of the mixture. Simple isolations of pure types have no doubt proved an improvement over the local mixtures in several crops like rice, cotton, *jowar*, etc., though it is a general experience with plant breeders that such improved types are of limited value beyond the narrow range of conditions obtaining in small tracts where they were isolated. It is more reasonable to assume perhaps that a mixture of types should prove of greater utility over a wider range of conditions. That certain components of a mixture in spite of their poor performance when grown pure, do manage to maintain themselves in a fairly constant proportion from season to season can only be explained by the advantage they get when grown in competition with other types. The Upland cotton of Central India, when grown as a pure rain-fed crop, suffers badly from diseases and is a poor performer but gains in competition when grown mixed with the indigenous cotton. There have been experiments going on for the last five years with growing these two cottons under different degrees of competition and while the results as regards yields are variable there is a definite indication that the Upland cotton gains by competition effects from the indigenous. There was, however, one consistent result obtained in all the years, namely, that the American in the mixed crop suffered less from leaf-roll and red-leaf than as a pure crop. There was also an indication of the indigenous cotton suffering less from wilt (*fusarium*) in mixed crop.

It might be worth mentioning here that there is experimental evidence to show that mixtures do contribute to better spinning quality. For the last two seasons, the material from the experiments with mixtures at Indore has been examined by the Director of the Technological Laboratory, Bombay, and as the figures given below would show, the mixture has a higher spinning value than the average of the two constituents sometimes even approaching the value of the better of the two constituents.

Spinning values (highest standard Warp Counts).

Mixtures.	1937–38			1938–39		
	Actual.	Average of constituents.	Difference.	Actual.	Average of constituents.	Difference.
M9* + M.43.4 ...	22	19·75	+2·25	16·5	17·25	−0·75
M9 + V.434 ...	25	22·50	+2·50	21·0	19·50	+1·50
M9 + M.U.4 ...	20·5	19·0	+1·50	24·0	22·50	+1·50

* M9 ... An arboreum strain evolved at Indore.
M. 43.4 ... Another arboreum strain under study at Indore.
M.U.4 ... An Upland cotton strain under study at Indore.

That fairly consistent results are obtained over two seasons and that similar results have also been obtained at the experimental mill, Egypt, (Hutchinson, 1938*b*) show that the mixtures are in no way a disadvantage from the spinning point of view. Even granting that the growing of mixtures is proved to be more profitable to the cultivator, there are several practical difficulties in giving effect to the findings, but still such difficulties should not preclude the breeder from examining the question.

IV. Development of Genetical Science.

i. *General.* In the early years of genetics, all attention was concentrated on crossing two types, observing the ratios in which any particular character or characters were appearing in the F_2, and deciding that the character or characters were controlled by a single factor, two factors, complementary factors, duplicate factors, etc. Any inheritance phenomenon of a complicated nature was usually ascribed to multiple factors and laid aside. The results all tended to nothing beyond the confirmation of the universal applicability of original Mendelian laws and their later extensions. The second phase of the development of the science of genetics was the study of the chromosomes and the unassailable evidence produced that they are the carriers of hereditary units or genes. All genetic evidence accumulated so far indicates that the gene offers an efficient mechanism for the evolutionary progress of living organism. Studies on the morphology of chromosomes and the irregularities in their behaviour have been used to determine linkage groups and changes in the inheritance of characters and their linkage relationship. There are some aspects of cytological research which are of great interest and importance to particular breeding problems, as for example, the chromosomal interpretation of species relationship, the conception of polyploidy and the explanation of sterility and peculiar forms of inheritance. Breeding programmes involving wide crosses between species or even genera are based upon the results of cytological research. The use of physical agents like X-rays, radiation, heat, cold, etc., has been brought into play to produce by artificial means changes and disruptions in the composition of

chromosomes producing mutations more abundantly and at a quicker rate than what were occurring in nature. More recently alkaloids like colchicine have been used to double the chromosome complement of an organism and thus make a sterile hybrid fertile. The advances in these branches of science, genetics and cytology, have no doubt had their effect on plant breeding. Hudson (1937) in his excellent review has brought together the cases where such advances have been made use of. The advances in the two branches which had remained entirely distinct through much of their developmental history are all converging to a common synthesis and understanding. One going through the literature on genetics that is appearing in recent times, will be really stunned at the progress that has been made. This progress, however, has not been of help to evolve plant breeding methods, but the plant breeder has still to keep abreast of the advances in genetics and cytology and try to incorporate the precepts in his own work so that he can have a greater control over his material.

In the field of breeding horticultural and vegetatively propagated crops the value of new genetical and cytological technique is appreciated and in attacking breeding problems full use is made of the latest advances in those branches. The recent work on potatoes may be mentioned in this connection. The only agricultural crop, where an effective collaboration between geneticists and plant breeders has resulted in results of practical value, is maize in America. It is in the breeding of self-fertilized crops that the value of such advances has not become as apparent as one would wish it to be.

ii. *Genetical work in India.* The actual position of the work in India in the light of the advances mentioned above may now be considered. Although actual plant breeding has produced tangible results of economic value, probably even more tangible than one would expect from the time and money spent on it, it must be admitted that the latest advances in genetical science have had no appreciable effect on this output. It was mentioned earlier that the first phase of genetical science was the phenomenon of segregation. If we look into the published papers in India within the last 25 years (1910—1935), there have been over 200 publications dealing with the inheritance of characters in crop plants. A large majority of them deal with the simple question of Mendelian ratios. It is only a few that might be considered to go beyond the question of simple ratios. It is known, however, that characters like yield itself and those that contribute to it, as for instance, the number and size of the ear in cereals like rice and wheat, and ginning percentage and lint length in cotton, to mention only a few, are quantitative in their inheritance and controlled by numerous genes each probably having a small effect and impossible to distinguish in the later generations of a cross. Genetical analyses on these characters are hard to follow because of their complex inheritance. Recognition of genotypes which is essential for the usual genetic analysis is generally very difficult as they cannot be separated from environmental fluctuations. Eye judgment in many cases are quite inadequate and simple empirical tests are not always available for isolating all genetic variants. The inheritance studies on such quantitative characters have therefore not received as much attention as they deserve.

The actual genetical contributions in India are from those who are practical plant breeders, and crop botanists working in the departments of agriculture, Provincial and Imperial. Their work is circumscribed by the immediate and pressing need of producing an improved strain of a crop, the introduction of which would bring a greater return to the cultivator. The material they set to work upon was the crop grown in the cultivators' fields which was an untouched and richly variable population, and simple selection had given very encouraging results. Almost all the improved strains that have been given out to the cultivators are such simple isolations. By the very nature of the material dealt

with, and due to local adaptations, the strains so evolved with rare exceptions, as for example, GEB. 24 rice and Co. 2 cotton of Madras, are necessarily limited in their usefulness to the particular areas in which they were isolated. This naturally led to the decentralization of plant breeding research, which was originally confined to a central station in each Province, and a number of small breeding stations, one in each of the important tracts of the crop, were opened where the crop of that locality could be studied. This is the experience in Provinces where plant breeding work has been going on for a longer time, as could be seen from the number of rice breeding stations in Madras and the number of cotton breeding stations in Bombay and Madras.

The earlier hybridization work that had been undertaken was intended to combine in one individual valuable attributes from one or more types and though the breeders did have a clear idea of what combination they wanted to achieve, the knowledge about the inheritance of the characters, they wanted to combine, was, however, lacking. Such hybridization programme was more or less a hit and miss method and if any success had been obtained, it was more an accident. The crosses were, however, useful for studying the inheritance of some of the easily distinguishable qualitative characters and most of the publications deal with such inheritance. This is practically the position, at any rate, with some of our most important crops like rice, cotton and wheat. In millets, where selection and genetical studies have been of a more recent date, almost all the publications deal with such Mendelian ratios and breeding for special yield attributes is still in its infancy.

Selection work, whether from a naturally variable material or from hybrid populations, was probably considered a mere routine which anyone with elementary knowledge of genetics could undertake. This might be true to some extent because of the nature of material one is dealing with in a country like India. That still greater achievements in plant breeding have not been recorded in India, might be attributed to the fact that the nature of the material available to the breeder was not correctly understood and too much emphasis was laid on purity of character, morphological and economical. It is desirable for a plant breeder to have a sound knowledge of the advances in genetics and cytology though he may not yet be in a position to utilize all such knowledge in his everyday work. That more tangible results have been obtained in some Provinces than in others might be partly attributed to the fact that breeding work was carried on side by side with genetical studies and also perhaps to better technique employed.

V. Genetics in Relation to Plant Breeding.

i. *Quantitative inheritance.* The advance in genetics as applied to the quantitative characters and what influence this is likely to have in plant breeding technique is dealt with here. It is true that new conceptions of multiple factors, quantitative inheritance, transgressive segregation, factor combination and inhibition have been invoked, but these have helped but little in practical plant breeding. The study of the inheritance of quantitative characters is intimately associated with applied mathematics and it is this that has practically scared away earlier geneticists and plant breeders from undertaking such studies. The application of statistical methods to living things is known as biometry and has developed into an important branch of biological investigations. Biometry is a necessary mathematical tool for dealing with the inheritance of quantitative characters and no modern geneticist can make much progress without a good grasp of this branch. As was pointed out in an earlier section, the variations on which breeder has to work are of two kinds, environmental and genetic, and it is only when the latter component forms a substantial portion of the total

variance, selection can be effective and the problem he has always to face is to reduce the environmental variance to the minimum by suitable technique. In the case of hybrid progenies, the classical method of selfing and selecting from F_2, F_3 and so on, has been the chief method followed and has proved successful in cereals, wheat, rice and also in cotton. As practical examples of successes in this line are rice strains evolved combining yield and strength of straw, yield and resistance to paddy blast, and yield and shorter duration, etc , in Madras. Similarly, the case of strains evolved recently by the Cotton Specialist, Coimbatore, combining yield and fine and long lint in Cambodia cotton may be mentioned. But such achievements have been brought about not with the definite knowledge of the inheritance of the particular characters whose combinations have formed the end in view. Can the geneticist suggest more rational methods of what to select and how to select in the hybrid progenies and give information on the genetic variance involved in the different generations starting from the F_2? A beginning has been made at Indore to answer these questions with regard to cotton and I should refer to the work of Dr. V. G. Panse who has just published the first results of this study (1930*a*, 1940*b*). Because of the special statistical methods involved, the work was carried out with the suggestions and guidance of Prof. R. A. Fisher. The quantitative character studied was lint length which is one of the important and at the same time complex characters in cotton, in crosses among *G. arboreum* types.

He has shown from theoretical considerations that the genetic portion of the variance in a population can be estimated by growing a set of progenies from individuals belonging to that population and taking the regression of progeny means on parental values. This is an important result, for, as has been stated before, the capacity of a population to show immediate response to selection depends on its genetic variability. The genetic variance in the F_2 population of crosses between C. 520, Malvi and Bani was estimated and is shown below:—

Cross.	Total variance in F_2.	Genetic variance.	Non-genetic variance.
C.520 × Bani ...	3·015	1·543	1·472
C.520 × Malvi ...	3·273	1·576	1·697
Malvi × Bani ...	2·416	0·375	2·041

In the first two crosses, nearly half of the variance is genetic, but in the third cross it is only fifteen per cent. of the total variance While the bulk of the non-genetic variation would be environmental, the presence of dominance and other interactions between factors would also contribute to it. The effect of non-genetic variability, whatever its source, would be to retard the progress made by selection.

In populations with the same amount of genetic variability the degree of improvement achieved by primary selection will also be the same but the response to secondary and later selections will be determined by the genetic constitution of the character, namely, the magnitude and number of factors involved and their dominance and epistatic relations. With only a small number of factors, the possibility of further improvement by selection will soon be exhausted, whereas with a larger number, selection can be continued profitably much longer. As the variation is continuous and the individual genotypes cannot be recognized, unlike in simple qualitative characters, only a statistical approach is available to study these questions. It does not mean, however, that the estimation of genetical variance and the number of Mendelian factors involved will straightaway solve the difficulties of the breeder, but if genetics is to play its part in the art of plant breeding such studies are essential.

ii. *Heterosis.* It is within the experience of every plant breeder that the first generation hybrid is more vigorous than the parents and such vigour disappears gradually in successive generations, and it is to this phenomenon that the term heterosis has been used. We need not go into the theory of heterosis, but it is enough to state that the problem of heterosis is the problem of the inheritance of quantitative characters. The heterosis effect has been demonstrated in crops with regard to several economic characters and the greater the gap in the relationship between the parents crossed, the greater the expression of heterosis. Can the plant breeder make use of the heterosis in his work? In vegetatively reproduced crops like sugarcane and potato, when once the cross has been made, the vigour associated with the hybrid can be maintained almost indefinitely. In cases where hybrid seeds can every time be produced in sufficient quantities to raise a field crop, the phenomenon is of benefit even in crops with sexual reproduction. This has been possible in maize and the advance in maize breeding in U. S. A. is nothing but the exploitation of this principle. Hybrid maize is the most outstanding example of the influence of theoretical scientific research in revolutionising the production practices of an agricultural crop. The same principle is being applied recently to breeding sugar-beet crop in Sweden. The only grain crop of India in which the breeding principles applied to maize, can be used is *bajra* (*Pennisetum typhoides*), but no serious breeding work has yet been taken up in this. In breeding self-fertilized crops on the other hand the expression of heterosis in any considerable magnitude is bound to arrest progress in selection. In the example of the cotton cross discussed in the previous paragraph, the portion shown as non-genetic variance would include the effect of heterosis. It must be stated in this connection, that it is so difficult to analyze the non-genetic variance apart from the fraction due to environmental effect into components due to dominance, heterosis, epistacy, etc., as they are all interrelated to each other.

iii. *Physiological and Genetic Correlations.* Another aspect of genetics in which more critical research should prove useful to the plant breeder, is with reference to characters that show physiological or genetic correlations. It must be within the experience of every plant breeder that selection for improvement on a particular character results in improvement only up to a point. Beyond that, gains are compensated by depreciation in other characters. There is evidence of several physiological correlations in crop plants like cotton, rice, and wheat. In developmental studies with cereals like rice and *jowar* in India, the correlation between yield and other characters like size of ear, height of plant, tillers, etc., have been extensively studied and recorded. To discuss a few of these in rice, the height of the plant is very highly correlated to duration (Ramiah, 1933) so that as a general phenomenon, late duration varieties are likely to be taller than short duration ones. Naturally this would set a limitation to obtaining a very short stature type with a long growing period and *vice versa* though there is likely to be a wide margin for variability in height or duration within the two groups considered separately. Similarly, a correlation is found to exist between yield and duration in the rice crop which may vary anything from 3 to 8 months. Generally under South Indian conditions the best yielders are those that have a medium duration of say, 5 to 5½ months. Though varieties of shorter duration, 3 to 4 months, are sometimes found to give high yields of 3,000 to 4,000 lbs. of grain per acre under particular conditions of soil and climate, they are generally not so heavy yielding as the later duration types. Varieties of over 6 months in duration, which people are obliged to grow because of certain special conditions in a particular tract, are generally also not very heavy yielders. That this relation is physiological can be seen from the series

of experiments that have been conducted with them in Madras (Ramiah, 1937). Since these long-duration varieties are generally season limited, any reduction in age beyond a certain minimum brought about by unseasonal planting reduces their yield potentiality. Now the question is whether a very high yield associated with a variety of, say, 5 months' duration can be combined with an early duration of 3 months. Experience in Madras would appear to show that breeding for such an end in view should prove a waste of time and effort. There was an interesting case in rice where an attempt to combine a packed arrangement of the spikelet on the panicle with a medium size of the grain ended in failure (Ramiah, 1931*b*). The close packed arrangement was always associated with a small grain. The correlation here may be either physiological or simply structural. The case of the cross in rice to combine panicle length and clustering of spikelets may also be mentioned. Combination of length in the panicle with the clustering of the spikelets proved impossible (Ramiah, 1931*b*, l. c.).

There are more chances of the breeder achieving his end, if the character combinations he is after, are genetic rather than physiological. In the case of cotton, within *G. arboreum* species there are types with very high ginning percentage, but with lint of very poor quality, and types with poor ginning but with finer and longer fibre. The cotton breeder would like to combine these two characters as high ginning and longer fibre as both contribute to a better price being obtained by the cultivator for his produce. Though critical evidence is lacking, it may be stated from the results of breeding data available, that it is not possible to combine the two characters beyond a certain limit. To get critical data bearing on the point, an experiment has been going on for the last three years in Indore which may be referred to here. In the F_2 population of the crosses between C. 520, Malvi and Bani, plants with the highest and lowest values of ginning percentage and with the highest and lowest values of lint length were selected and F_3 progenies grown from these. The correlation coefficients between the mean values of the progenies for ginning percentages and lint length are:—

C. 520 × Bani	...	−0·254
C. 520 × Malvi	...	−0·425
Bani × Malvi	...	−0·286

All the three coefficients are negative but insignificant. The combined correlation coefficient is −0·324, which just falls short of significance on the 5 per cent level. This small negative relation between ginning percentage and lint length is reflected in progenies selected for high ginning percentages having a slightly lower lint length than those selected for low ginning. It is probable that this negative association is genetic rather than physiological, because no such consistent relationship is observed between the ginning percentage and lint length of the individual parental plants of these progenies. The fact that the proceesses of lengthening and thickening of the cotton fibre do not take place simultaneously also supports the conclusion that the relationship is not likely to be physiological.

Cases of several correlations between morphological and quantitative characters have been recorded in cotton and rice and to have an idea of the scope of such correlations the following few may be mentioned here:—

Cotton:—between corolla colour and lint length; between corolla colour and lint index (Hutchinson, 1931); between red plant body and length of vegetative period (Leake, 1914), and lint colour and lint length (Kottur, 1923).

Rice:—between sterility and growing period (Ramiah, 1931*a*); between anthocyanin pigment and yield (Ramiah, 1933 l. c.); between anthocyanin

pigment and tillering (Ramiah, 1935) and between colour of grain and weight of grain (Parnell *et al.*, 1922).

Such studies in other crops should prove very useful to the plant breeder.

iv. *Use of 'Discriminant function'*. In very recent times the question of the use of 'discriminant function', first suggested by R. A. Fisher (1937) in plant breeding has been brought i . The only paper we have relating to the subject is that of Fairfield Smith (1937) which relates to wheat and he comes to the conclusion that with a number of lines derived from a 'composite hybrid mixture', initial field selection for yield might be made on the basis of the size of the grain. In simple language the principle may be explained as below. In every crop the yield could be divided into a whole set of different features as for example, the number of ears, the number of grains per ear and the weight of the individual grain in cereals like rice and wheat. The analysis of yield might show that certain of these attributes are more variable due to environmental conditions than others, and in basing selections for yield, more weight should be given to such an attribute that shows less variability due to environment. The principle is perhaps not new as the developmental studies initiated by Prof. Engledow in Cambridge did take into consideration the yield attributes in making selections, but no systematic experiment has been made on the points. In rice breeding also such attributes of yield as tillering, ear size and grain size have been used successfully. A necessary requirement for the use of a discriminant function is experimental data to determine what measurements are least affected by environmental fluctuation. In cotton for instance, there are several characters which are components of yield such as bolls per plant, seed cotton per boll, seeds per boll and lint per seed. Though from experience it may be stated that some of the above attributes like bolls per plant were much more variable than others, an attempt is being made in Indore to get experimental data to see how far we can use the 'discriminant function' in cotton breeding.

v. *Wide Crosses*. The problem of the wide crosses and study of the range of variability in crop varieties may be considered at this stage. This has come to the forefront because of the work of Vavilov and other Russian botanists and because of the great advance made recently in the study of polyploidy. One often hears of the necessity to have a wide collection of types for use in breeding. So far as India is concerned, the point has got its possibilities as well as its limitations. For instance in cotton, India being itself the home of one of the most important species *G. arboreum*, with several secondary centres of origin (Hutchinson and Ghose, 1937*a*), there is nothing probably to be gained by bringing in new collections from outside so far as this species is concerned. But the demand for producing better quality cottons in India is sometimes considered capable of solution by the increase in the cultivation of Cambodia or Upland cotton (Ramanathan, 1938). All the types of this cotton that are now being grown extensively are the relics or acclimatized types of Upland Americans introduced from America in earlier years. Selection from the introduced types of America has not been very fruitful. No material from the original source with plenty of genetic variability has been tried and it is possible that in its original home types may be available that may prove suitable to tracts in India which do not grow this cotton now. It is from this point of view that an extensive collection of material from the original source might prove of interest. Similarly, intensive attempts by breeders to improve *G. herbaceum* cottons of India have led to the same inference that material from outside India should be introduced (Ramanathan, 1936).

With regard to rice, there is plenty of variability to be found in the various parts of India and there appears to be no justification for introducing variable

material from outside. There are still several unexplored regions within India itself and work in Coimbatore has shown that such exploration is bound to give the breeders new species, still undetermined, which may be usual to them. The importance of wide crosses particularly with wild types is receiving increasing attention and the results of such work elsewhere and in India too have been useful in introducing into the cultivated types, characters such as hardiness and resistance to diseases which are usually present in wild forms. From this point of view, collection of wild types is certainly desirable and it has proved of practical importance in sugarcane already. Similar results are expected in potato also. Exploration of wild types particularly in the improvement of fruit has not received any attention it deserves in India, though North East India is known to be the original home of certain citrus types.

Though there has not been much of genetical work as related to wide crosses in India itself, workers in India have not failed to make use of the knowledge accumulated elsewhere in attempting wide crosses. More from the scientific point of view, some years ago a programme of crosses between different species of rice was undertaken in Coimbatore. Some of them had proved of cytological interest and in throwing light on the phylogeny of rice (Ramanujam, 1938), (Parthasarathy, 1939). It is interesting to note that the progenies of one inter-species cross *O. sativa* × *O. longistaminata* has given some material of economic value. In one of the papers contributed to the agricultural section of this year (Sreenivasan *et al*, 1941) is recorded the obtaining of drought resistant strains from the above cross. It is quite likely other interspecies crosses might also give useful breeding material.

Regarding interspecies crosses in cotton though crosses within the Asiatic species and within the New World species are practicable and have been extensively tried, there is no record to show of any valuable material having been obtained from such crosses. Harland's work (1932) has shown that crosses can be effected between the two Asiatic species and between the two New World species, but homologous characters are built up in such widely different ways in them that the genetic balance is usually disintegrated by segregation in F_2 and later generations. He has, however, shown (1936) that it was possible to transfer single genes or small groups of genes from one species to the complement of the other, but not breeding of intermediate types. This is achieved by the technique of repeated back crossing and one of the recent cases where a success has been reported (Knight and Clouston, 1939), is a cross between *G. hirsutum* × *G barbadense* where the resistance to 'blackarm' in one of the strains of the former has been transferred to a type of the latter using the above technique The crosses between the Asiatic and American species are still wider since they involve differences in chromosome number as well. But even such wider crosses have not scared away plant breeders and have been made in Russia and recently in India as well (Amin, 1940). The knowledge about the use colchicine in doubling chromosomes has encouraged these attempts and since the work is still in an experimental stage, nothing can be stated definitely about its economic possibilities.

In fact, the lead in the attempt at wide crosses has come from India particularly in sugarcane, due to the enterprise of Rao Bahadur Venkatraman. He has succeeded in making such wide crosses as between sugarcane and sorghum and more recently even between sugarcane and bamboo. The latter work, though still in its infancy, appears to show enormous possibilities of improving the sugarcane crop. It must be remembered, however, that sugarcane is a vegetatively propagated crop and the difficulties of further selection are absent.

In rice where all the cultivated forms are grouped under one single species with the same chromosome number, there are geographical races which differ in

their chromosome make up. Crosses among such races are possible and have been repeatedly made in spite of initial difficulties in several cases, but still there is no record of any considerable practical success having been obtained by such crosses anywhere. The case is, however, different in cotton where different races of *G. arboreum* and *G. herbaceum* exist with the same chromosome numbers and hybridization among them within the species has given results of practical value.

vi. *Limitations in wide crosses.* With our present assumption of a large number of genes controlling quantitative characters, one should expect to get all possible combinations of characters in the F_2 and later generations provided, a sufficiently big population is grown of them. Recent work by E. Anderson (1939 *a* and *b*) on the point is very illuminating. He has shown by experimental data in a species cross in tobacco that, however manifold the recombinations might seem, they are in reality but a small proportion of the possible recombinations of the parental species. He discusses the powerful restrictions to character recombination in F_2 under four heads: gametic elimination, zygotic elimination, pleiotropy and linkage. Every plant breeder must be quite familiar with gametic and zygotic eliminations in crosses between species or races which manifest themselves by pollen sterility and non-viability of seed produced. The question of pleiotropy where a single primary effect of a gene results in manifold effects on the development of the plant has not received as much attention as it probably deserves. Recently we have been studying in Indore the pleiotropic effects of one of the genes that is responsible for lintlessness in cotton. The homozygous lintless type is a much shorter plant with suppressed internodes, somewhat late in maturity and with a definitely different growth rate as compared to the linted type. The lintless type has also shown variations in its survival according to the environmental conditions. The large number of genes controlling quantitative characters located in the various chromosomes should, as shown by Anderson, be closely linked because of the restricted number of crossovers possible in the chromosome. It is definitely proved that in spite of variations from plant to plant in the hybrids as a group, the characters of the parental species or races tend very strongly to stay together. The above findings have an important bearing on plant improvement. In this connection mention might be made of a serious effort made in Coimbatore over a series of years to obtain a valuable combination of characters found in different races of rice. One of the types originally imported from Java had a special characteristic of very long ears, about twice the length of any to be found in the local types, but the length was compensated in this variety by extremely poor tillering, i. e., fewer heads per plant. The attempt made was to combine the ear length of this variety with a greater number of smaller ears in another standard strain. The cross was carried on up to F_9 and F_{10} selecting from each generation in the usual way and ultimately when the final selections were compared against the local strain, they failed to approach the yield of the latter, It is known that tillering and ear length must be controlled by several factors and the failure of the attempt to synthesize this desirable combination only shows that such a combination, high ear number of one parent with the length of the ear of the other parent did not occur in the cross. We should probably have been content in this cross with an intermediate tillering and intermediate size of ear. As Anderson has pointed out the most efficient way of achieving the desirable combination would have been to make crosses among selections which are most like one of the parents in ear length with those which are most like the other parent in ear number. In this connection another interesting cross in rice which has been attempted in the United Provinces might be mentioned (Sethi *et al.*, 1937). The problem of rice fly infestation is important in this tract and trials are being made to get over

the difficulty by producing types with enclosed earheads by crossing the ordinary type with another *sathi* type, where the earhead remains enclosed inside the leaf-sheath (cleistogamous). The *sathi* rice is a very poor yielder and has a coarser grain, but cultivators grow it for this one character of its escaping the attack of ear fly. The cross has been carried up to F_8 or F_9 generation and types with enclosed ears have been obtained which are an improvement over the *sathi* rice, but not comparable to the normal type in yield The inheritance of the enclosed ear type has been studied and found to be of the multiple factor type and it is quite possible greater progress might be achieved by crossings among selected types, those *approaching* the *sathi* parent in ear character and those *approaching* the normal type in yield from the hybrid generations. This is probably a definite case where advances in genetical knowledge could be put to practical test in economic plant breeding.

VI. Maintenance of Purity of Strains.

The question of the deterioration of strains once fixed and released for distribution to the cultivators might be considered. It is a usual complaint from cultivators that a strain, though known to give a good performance to begin with deteriorates after a period of time. Such deterioration where it is proved to exist may be either due to non-genetic or genetic causes. In spite of the fact that sugarcane is a vegetatively propagated crop, the deterioration of the Coimbatore types intensively cultivated in the United Provinces can, from the data available so far, be shown to be due to greater incidence of pests and diseases because of the faulty agricultural practices, namely, the growing of the crop repeatedly without sufficient rotation in exhausted soils. In the case of self-fertilized cereals like rice and wheat, so far as simple (selections) pure lines distributed by the Departments are concerned, there is no evidence of such deterioration. Once, seed of a strain of rice (GEB. 24) in Madras was obtained from the district where it had been distributed four years previously and in an experiment at the central station no sign of deterioration could be found. It must be pointed out, however, that the seed was to all practical purposes as pure as the seed of the experimental station itself. A similar result was obtained in Coimbatore with regard to Co. 2 cotton strain (Ramanathan, 1937). Dr. Shaw (1935) mentions a case where one of the Pusa strains of wheat had been declared to have deteriorated, but he found the seed obtained from the locality to have been badly mixed up with other types. Fairfield Smith (1938) has mentioned a case in America where some of the wheat strains from Turkey Red Wheat which were very much better than the control to begin with ultimately came down to the level of the control after some years While deterioration due to the strain getting mixed up with other inferior strains in the course of cultivation by growers is beyond the scope of the breeder's work, deterioration due to genetical causes comes within the breeder's purview. In the case of cotton when once a strain has been released for distribution, the only thing we know is that the genetic variance has been reduced to such an extent as not to be detected by ordinary methods of plant breeding, but there can still be sufficient genetic variability left in the material which can exhibit itself in course of time. Though experimental proof is not available, it is possible that in quantitative characters controlled by a very large number of genes, there may be small mutations (East, 1935) and such mutations can result in deterioration. If the residual genetical variability left in the strain is such that the strain consists of genotypes some slightly better than others, deterioration can result by the gradual increase of the poorer ones. By the adoption of a small replicated progeny row test at the breeding station every year, we can weed out poorer genotypes from the material. Such deterioration due to genetic causes is known to exist even in self-fertilized cereals where the strains are from hybrids. Such

strains are known to throw 'off-types' after some generations (Engledow, 1933) and the gradual deterioration in this case might be attributed to a residuum of impurity and the decreasing percentage of heterozygosity from generation to generation. In progenies of wide crosses such 'off-types' might occur due to cytological causes, losses in chromosome segments or even whole chromosomes (Love, 1939). It follows, therefore, that a well-organized scheme of seed multiplication and distribution must be continuously kept up. A nucleus must always be maintained at the breeding station to form the primary source for multiplication. The Cotton Committee have recognized this principle and are actually financing schemes for maintaining nucleus of cotton strains evolved at the breeding stations.

VII Organization of Genetical Research.

In the preceding pages a brief outline of the plant breeding and genetical work in India has been given and indications made in what aspects the advances in genetical science can influence plant breeding practices. Plant breeding, as has been pointed out already, has a definite utilitarian end in view, namely, that the cultivator must get something more than what he gets now by growing the new variety put out by the plant breeder. This is, in fact, the touchstone for the ultimate success or failure of any plant breeding programme The attempt of the breeder to find something better than the existing one is, from its very nature, a never-ending scheme and hence the research has to go on continuously. Unlike other aspects of agricultural research, plant breeding work is capable of giving returns, several times that of what is actually spent on it and there is also the additional advantage of the results of plant breeding research being taken up readily by the cultivator as it involves no additional expenditure on his part

Though the advances in genetical science have come mainly from the work in organisms of no economical value like *Drosophila*, *Oenothera*, *Datura* etc., so far as India is concerned, the little genetical work that has been done is all related to agricultural crops. A great deal of genetical work even in these crops yet remains to be done. While part of it may be of practical value, it may include also other aspects which would simply add to our knowledge of these crop plants. The latter might be called basic research in genetics, and there must be some organization to carry on this work. The crop botanists of the provincial departments of agriculture have always got the pressing problem of producing improved types by ordinary breeding to replace existing types of crops and all of them cannot undertake problems of basic research either for want of time or want of facilities. Autonomous bodies created for individual crops like the Indian Central Cotton Committee for cotton have recognized the importance of such basic research. This body is financing a genetics research scheme in cotton. This basic research carried on at Indore is concerned mainly with one aspect, namely, research that has a direct bearing on plant breeding technique. The Jute Committee which has recently come into existence is expected to do for jute what the Cotton Committee is doing for cotton. The Imperial Department of Agriculture formerly at Pusa and now in Delhi is doing a considerable amount of plant breeding work of practical value and also a certain amount of basic research on genetics of crops. The Imperial Council of Agricultural Research is the other body created as a result of the recommendations of the Royal Commission on Agriculture that can arrange to see that such basic research in crops is carried on. The finances available with this body have been rather limited previously, but due to the passing of the Agricultural Produce Cess Bill recently, there is likely to be considerable improvement in the near future. This body has spent during the last 10 years (1929-30 to 1938-39) a sum of about 25 lakhs of rupees on crops generally, including all aspects of research besides

another sum of about 16·5 lakhs on sugarcane alone. Of the former amount, nearly 50 per cent. has been devoted to financing schemes of rice research in provinces. This amount spent by the Imp rial Council of Agricultural Research on crop research is in addition to what the Provinces and States are spending from their own budgets. It will still be worth mentioning that what is spent on this research in India, considering the size of the country, variety of crops and problems, will not compare favourably with what is spent on similar work in countries like Japan and Egypt. Towards plant breeding and genetical research, the former spends about 28 lakhs of rupees and the latter 5 lakhs of rupees annually. Looking into the nature of the schemes financed by the Imperial Council of Agricultural Research with regard to crops, with the exception of a few which can be termed basic research, the majority of them are of a routine nature, ordinary plant breeding schemes. Some of them are schemes either on new crops, for example, fruits, where no systematic work had been done previously or on crops which certain provincial departments of agriculture had not done any work on previously in spite of their importance to them. With regard to rice, a certain amount of basic research has been done under the schemes, but the bulk of them have dealt only with problems of local interest, namely, evolving improved strains out of local varieties in the Provinces. Even the programmes of basic research I am referring only to genetics here, have not generally been on any preconceived and co-ordinated plan. There is no doubt that with greater co-ordination, more valuable results might be achieved. One example of what a good co-ordinated scheme of basic research can be, might be mentioned from America. Maize (corn) is the most important cereal of the country, perhaps not more important than rice to India, and every University or State Agricultural College is doing some work on the crop. In 1928, corn geneticists initiated a systematic study in which each of the 10 chromosomes of corn was assigned to workers in different institutions This co-ordination of effort has eliminated much duplication and has speeded up the research programme to a remarkable extent. The inheritance of over 350 genes has been studied and their position in individual chromosomes has been determined.

Due to the initiative of the Imperial Council of Agricultural Research, methods of describing crop plants from the genetical point of view have been standardized with regard to the two crops, cotton and rice (Hutchinson and Ramiah, 1938*b*), and similar work is in progress with regard to other crops also. When the available material has been actually described according to the methods prescribed, it should go a long way in helping the breeder to understand the material available with his colleagues in other parts of India.

When the problem of plant breeding work in India was discussed before the Crops and Soils Wing of the Board of Agriculture in December, 1937, it was considered that plant breeding research may have to be carried on at several centres particularly in crops with limited adaptability, examples, rice and cotton, but that basic research should be confined to one or two selected centres only. Involved with the question of basic research is the question of crop introduction. The question of the formation of the Bureau of Plant Introduction under the auspices of the Imperial Council of Agricultural Research had already been discussed at two meetings of the Board of Agriculture, 1935 and 1937, and the principle has been accepted. Now that the finances of the Imperial Council of Agricultural Research are likely to be augmented, the question of the starting of an organization on the model of the Bureau of Plant Industry in United States of America might be considered. This bureau in America which works with headquarters at Washington has got on its staff a large number of eminent men on the different branches of crop research, and such men not only co-ordinate the various items of research in the different States, but also place at the disposal

of workers or bring to the notice of workers of achievements in their branches recorded elsewhere. The Bureau is also in charge of the introduction of crops and plants into the country and arranges for their tests in suitable centres in co-operation with individual States. The Bureau also undertakes, whenever necessary, to send individuals and expeditions to various parts of the world to collect material of value for breeding purposes. Will it be too much to expect that a beginning on this model will be made in India?

While the advances in the science of genetics have been dealt with chiefly with reference to crops, the principles are of equal application to animals as well. The principles of genetics have hardly been utilized in the breeding of stock in India and I do not know whether genetics is ever taught to the students of the Veterinary Colleges. There is still another aspect of genetical science as applied to human race. The science of biometry in its application to genetics has been responsible for all our present-day knowledge on human inheritance (Eugenics). I am not sure that sufficient attention is paid to the teaching of eugenics to the students in any of our several Medical Colleges in India. A rough idea of the development of genetical science along diverse lines can be had from the papers that were contributed to the Seventh International Congress of Genetics held in Edinburgh in 1939. There were 353 contributions grouped as below:—

Gene and Chromosome theory and Cytology ...	61
Physiological genetics	46
Animal breeding in the light of genetics	53
Plant breeding in the light of genetics	46
Human genetics	51
Genetics in relation to Evolution and Systematics ...	52
Statistical genetics	17
Genetical aspects of growth—normal and abnormal ...	27
Total ...	353

VIII. Genetical Work and Universities.

Before I conclude I should like to say a few words about our Universities. There are seventeen Universities in India, almost all of them having affiliated colleges teaching up to Honours degree in biology but not one can still boast of a chair in genetics. The Honours students in Botany do, I believe, receive a few lectures on principles of Mendelism, but whether they get anything beyond that is very doubtful. Recent advances in genetics have had a profound effect on our knowledge of taxonomy and ecology, but still it is doubtful if students are made to get a grasp of such principles in their taxonomic studies, which so far as I know, still form a big portion of the botany syllabuses in the colleges. It is a point worth considering whether the taxonomical syllabus should not be cut down a little and the same substituted by genetical studies on agricultural crops. Even in connection with the taxonomical studies in the Universities, botanical excursions to key regions of agricultural crops and plants in co-operation with the crop botanists could be usefully undertaken. There is a wide field for this work in India particularly with our important crops, rice, sugarcane, fruit trees, etc.

There is one branch of botanical research in which several Universities have got competent Professors to undertake and guide research. I am referring to cytological research. From what has been said in the earlier portions of this address, it will be evident that most of the latest advances in genetics have come from cytological research. Still most of the cytological work done in India

refers either to the embryo-sac development in some unimportant plant or determination of chromosome numbers. The plant breeders in the course of their work come across various problems necessitating intensive cytological studies which can easily be undertaken in the Universities. In some cases where crop botanists are making fundamental studies on their crop, they have their own cytological sections, but still I feel that this is a branch of botanical research in which the Agricultural Departments and the Universities can well co-operate in the interest of maximum output in the country. In recent times there have been a large number of brilliant young men who have gone abroad for intensive cytological studies and returned to India. Surely, it should be possible to make use of these men in this work. Even in other branches of botanical research, physiological genetics, for example, such a co-operation between crop botanists and Universities should prove extremely beneficial. I am mentioning the above points not with an idea of criticising the botanical work in the Universities, but to draw attention to the necessity for a change in the outlook. I am sure the difficulties, if there should be any, against such co-operative work, could be got over by personal contacts of individuals interested in common problems. The Imperial Council of Agricultural Research, when it was first formed, did have as one of its objects, bringing about a greater co-ordination between Agricultural Departments and Universities and it has succeeded to some extent in the attempt. Two instances of such successful co-ordination may be mentioned in this connection, namely, the rust work in wheat, and the general statistical work as applied to agricultural experiments. Let us only hope that such healthy contacts between workers in the Agricultural Departments and the Universities will be brought into effect in an ever-increasing measure, resulting in a greater output of basic research in the country.

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EXTRACTS

Save your own Tomato seed. Growers should exercise every care that tomato seed is taken only from strong, vigorous, and healthy plants of high productivity, and that the tomatoes selected should possess the necessary characteristics of the type which it is desired to produce and which will be most suitable for the locality where production is being carried on.

Selection intelligently and carefully carried out will give, in from three to five years, strains of seed greatly superior and better adapted to one's own conditions than any which it is possible to purchase.

Literature available on the subject is definitely in favour of home-grown seed selection as a means of improving the strain of the variety grown and also of increasing the yields of fruit. There is considerable evidence that yields can be materially increased by selection, and that home-grown seed from disease-free plants of high productivity and early maturity produces heavier crops than much of the purchased seed, particularly that of unknown origin. Seed taken from the product of low yielding plants will almost invariably produce weak plants of poor germination, while seed taken from the most productive and most uniform plants will produce the heaviest crops with a high percentage of uniformity. High productivity and early maturity can be obtained only from selected vigorous, healthy and disease free plants.

Plant Selection. To achieve these results, special attention should be paid to plant selection, and, in addition, good cultural practices must be adopted. Unfortunately, the fact that high prices may be paid for seed is not always a guarantee of high quality.

It has been established that certain plant diseases can be and are transmitted through the seed, and tomatoes are particularly susceptible to hereditary disease. In selecting tomatoes for seed, while many growers contend that they should be taken only from the bottom truss of fruit, exhaustive experiments carried out in seed production do not justify this contention. If, when secured, the tomatoes from which it is intended to extract the seed are not fully ripe, they should be kept in a reasonably warm place until well ripened. It may be noted, however, that vine-ripened fruit is considered best for seed production.

Method of Extraction. The tomato should be held in the left hand, and, with a sharp knife, cut through the centre at right angles to the stem, separating the fruit in two. Holding one half in either hand, cut surface turned downwards

subject each to gentle pressure until the entire pulpy content is squeezed out into a scrupulously clean receptacle placed under the hands of the operator. By this method—through the rejection of the main bulk of the tomato—all the seeds are obtained, and, in the final washing, a great amount of labour will be saved.

After this operation is completed, the pulpy mass in the receptacle should be held at a temperature of not less than 65°—70°F for five or six days while fermentation takes place. Some growers stir the pulp occasionally with a clean piece of wood, but this is not necessary. Other growers allow the mass to settle, which results in a thick coating forming on top.

Washing the Seed. In washing the seed, plenty of fresh, clean water is absolutely essential. Assuming that the pulp has been kept in a clean petrol or kerosene tin and that this is half-full, the contents should be well stirred and the tin almost filled with water. A good plan at this stage is to use both hands for the purpose of gently crushing any lumps which may be among the pulp, as it will be noticed that quite a lot of seeds will be adhering to them. Having given the seed a little time to settle, and while the pulp is still floating among the water, start the process of separation by gently pouring out the contents from one "corner" of the tin until the seed is seen to appear. This operation should be repeated—using plenty of water—until the seed is separated from the pulp, when it is finally poured into a fine strainer and allowed to drain. After draining it may be spread out thinly and dried quickly,

Before storing for future use the seed must be perfectly dry. Damp seed will result in premature germination. As the "life" of tomato seed is from five to six years, a considerable quantity can be produced from one crop. There are from 5,000 to 6,000 seeds in one ounce, and the germination of one-year-old seed ranges from 70 per cent. to 85 per cent.

This method of tomato seed extraction is equally applicable to the small grower, provided, the suggestions made are adopted and the directions given are followed, *New Zealand Jour. Agri.* 1941 62, 260—261.

A New Species of Coleus. *Coleus vettiveroides*, K. C. Jacob. Herb succulent, 45 cm.—53 cm. in height, bushy with slightly decumbent branches; stem 1·25 cm. in diameter, slightly purplish, pubescent with white short hairs, main stem more or less four-sided and branches nearly terete; leaves opposite; petioles 4 cm.—6 cm. long, pubescent, purplish, ventrally furrowed dorsally rounded (terete); lamina thick, nearly rounded 8 cm.—10 cm. long, 9 cm.—12 cm. broad, sparsely pubescent on the upper surface and densely pubescent below; nerves palmate, main nerves 12, margins dentate. Roots fibrous 35 cm.—50 cm. long when grown in sandy areas, straw-coloured, turning dark after a day or two, aromatic when fresh. The plant has so far been seen only under cultivation at Shiyali, Tanjore District; Palni in Madura District; Conjeeveram in Chingleput District, etc., in the Madras Presidency, and it has not been seen in flower anywhere at any time. The plants were specially grown at Shiyali in Tanjore District, South India, a natural habitat and at Coimbatore. All attempts at inducing flowering have failed at both places. There is a specimen of this plant in the Madras Herbarium at Coimbatore labelled *Coleus osmirrhizon* Elliot. Tamil: Kuru Veru, collected at Mahabalipuram, Chingleput District, by T. Abboy Naidu on the 25th May, 1879. This name (*Coleus osmirrhizozn* Elliot) could not be traced in any of the literature available here. The Curator of the Herbarium, Royal Botanic Gardens, Sibpur, Calcutta, considers it as only a manuscript name. This specimen also is without flowers. There is a good deal of confusion in the local name of the scented roots of *Vetiveria zizanioides* Nash. (a grass) and those of this species of Coleus, the specific name of which has not been determined. With a

view to clarify this confusion, a questionnaire was sent to some of the most important places where these two roots are very well known locally, and information obtained through the Agricultural Department Officers. Four local names, *viz.*, Vetti ver, Kuru ver Velamichai ver and Ramacham were reported to be in common use for these two scented roots. The consensus of opinion is that Vetti ver and Kuru ver are synonyms and are used for the roots of the Coleus species and Velamichai ver and Ramacham are two linguistic names for the grass, *Vetiveria zizanioides* Nash , the former in Tamil Districts, and the latter in Malayalam speaking Districts and States.

The roots of this Coleus species are known as Vettiver in Tanjore, North Arcot, Coimbatore, Madura, Tinnevelly and Ramnad Districts. The same root is known as Kuru ver in Chingleput, Tanjore, North Arcot and parts of Madura Districts. Vetti ver and Kuru ver are synonymously used in Tanjore, North Arcot and parts of Madura Districts.

In Shiyali Taluq of the Tanjore District where this Coleus species is extensively cultivated on the sandy banks of the Coleroon river, the names Vetti ver and Kuru ver are synonymously used. At Palni in Madura District where it is under cultivation in sandy garden lands it goes by the name Vetti-ver and at Conjeeveram in Chingleput District where it is cultivated on the banks of the Vegavathi river it is known as Kuruver.

The fresh fragrant roots of Vettiver (Kuruver) are used from time immemorial in the decoration of the idols in the South Indian temples of the Tamil Districts and also in the ladies' toilet for dressing hair.

The well-known Khus-khus or Cuscus of Commerce is known as Velamichai or Velamichaver in all the Tamil Districts. Viz., Tanjore, North Arcot, Madura, Tinnevelly, Coimbatore, etc. In parts of Tinnevelly District it is also known as Lamachan or Ramacham Ver. Ramacham is the well-known name for this root unmistakably used throughout the Malayalam speaking area. It is called Vetti ver at Vellaikulam in Chingleput District adjoining the Telugu area.

The fragrant dried roots of the Khus-khus are used for making mats, chick-thatties, fancy fans and 'Kavadies'. It is also employed in the adulteration of Vettiver at Srivilliputhur, Ramnad District. These roots are scented only at certain seasons of the year (Madras Agricultural Department Year Book 1918, pp. 67–69). It is extensively cultivated on the coastal regions of the Ponnani Taluq of the Malabar District It is also grown to a limited extent at Srivilliputhur in Ramnad District mainly for adulterating with the roots of Vettiver (*Coleus sp.*). This grass is found commonly in swampy or moist situations in Mysore, South Kanara, Malabar, Coimbatore, Chingleput, South Arcot, Nellore, Kistna, Godavari, Vizagapatam and other Districts. But the extraction of Khus-khus at the proper season and the manufacture of chick-thatties, fans, etc., are carried on as a cottage industry by the moplah community (Malayalam speaking Muhammadans) of the Ponnani taluq in the Malabar District.

The dried roots of this grass retain the pleasant and strong aroma for a very long time even for some years, while only fresh roots of Vettiver (Coleus sp.) are scented and made use of since they become odourless as they dry up in the course of 3 or 4 days. The fresh Vettiver roots are strawcoloured but soon become dark as they dry up, while those of Khus-khus retain their straw colour even after drying.

In the Telugu Districts of this Presidency starting from the Chingleput District right up to Ganjam, Khus-khus roots are known as Vetti ver. The idols in the Telugu temples are not generally decorated with any scented roots. Since

khus-khus is known as Vetti ver, the products of Khus-khus, viz., chick-thatties, fans, etc., are also known as Vettiver thatties, fans, etc., in these parts.

It has already been shown that Khus-khus and Vettiver (also known as Kuruver) are the roots of two different kinds of plants but are recognised by different conflicting names in different localities of this Province. This misnomer in the local names has been carried so far that the local name of the Coleus species was given to a species of grass, *Vetiveria odorata* Virey., as early as 1827. Hooker, in the Flora of *British India*, puts Vetiveria as a subgenus of Andropogon and called this plant *Andropogon squarrosus* Linn. f., but Gamble, in the *Flora of the Presidency of Madras*, names this grass as *Vetiveria zizanioides* Nash. The local name of this *Coleus* has become the generic name of a group of grass, one of which has scented roots.

Vettiver or Kuruver (*Coleus* sp.) is largely cultivated on the river banks in sandy loams. It is propagated by planting young shoots and plants are ready for lifting in about 4 months when the roots would have attained the maximum length and possessed with best aroma. It needs heavy manuring and constant watering.

This species of Coleus which has not so far been correctly named is designated as *Coleus vettiveroides* K. C. Jacob. The specific name *vettiveroides* is after the most popular Tamil name of the plant in places where it is largely cultivated. K. C. Jacob, *Jour. Bom. Nat. Hist. Soc.* Vol. XLII, No. 2, 1941.

Gleanings.

Stimulation of Root Formation of Sugarcane with Ethyl Alcohol. The desirability of ensuring root formation for studies on germination of sugarcane led to the treatment of seed pieces with various growth-inducing substances, including indole butyric acid, water, ammonium phosphate, calcium nitrate, and ethyl alcohol. A 5 per cent. solution of 95 per cent. ethyl alcohol proved to be the most effective treatment for stimulating root formation, especially at low temperature (69°—75°F.). Optimum time of treatment was between 24 and 48 hours. Less stimulation occurred in young seed pieces than in more mature planting material, suggesting that the ethyl alcohol serves as a readily available, high-energy food. *Hawaii Agr. Exp. Sta. Rep.* 1940—37.

Agricultural Improvement means Agricultural Education. The present lack of training facilities for young people in agriculture is probably largely responsible for the lag there is in the industry between the proved value of new knowledge and its application. In contrast with this we have the gratifying and, indeed, remarkable fact that great additions to our knowledge of agricultural problems have been made by British scientific workers in many branches during recent years and, alongside them, the demonstration of their commercial value has been proved in many directions. The feeding of livestock, the improved treatment of grassland, the value and preparation of ensilage, improved knowledge of manuring and many improved methods in vegetable and fruit production are familiar examples. It is not too much to say that the names of some of our chief agricultural research workers and of their institutes are known all over the world, but I believe, it is true to say that there are thousands of British farmers who have only the vaguest idea as to what these men stand for—if any idea at all.

Our Agricultural Colleges and Institutes and the staffs employed by county councils have done splendid work in evoking the interest of farmers and in spreading knowledge in the face of great difficulties, but I have not met one of

them who is not impressed by the need for more—very much more. There is this to say also, that, where the possibilities arising out of the application of new knowledge are brought home to them, there is a responsive spirit in the industry. Those of us who have attended young farmers' clubs and meetings of farmers, especially when there has been a good proportion of young farmers present, must have been impressed by the keenness displayed by many. There is a great field ripening for harvest in agriculture. But the reapers are far too few.

The question is: How are we to secure the more rapid infiltration into the practice of the industry of the lessons of new knowledge of proved value, and thereby lift up the standard of those engaged in it?

We need, I think, to do something affecting education generally at the beginning. There should be a great extension of the vocational elements in education in rural areas with facilities for transition to institutes for suitable candidates.

It is true that a good general education is an essential basis for us all. But our educational standards have been far too much dominated by a traditional leaning to, what may be described as, the arts side in prescribing the character of our education in rural areas for older children. We have the great laboratory of nature at our door and far too little use is made of it. One knows, of course, that many schools are to be found in rural areas where an enterprising teacher has developed this side of the school work with splendid results, but the dependence is far too much upon the enterprise of the individual teacher. The impulse is not provided in any thing like the measure it ought to be in our educational system. *The Field*, 2 November 1940.

Guarding Britain's Cornfields.

How Farmworkers will Fight Nazi Fire Bombs.

With 12,500,000 acres under the plough this spring—3¾ millions more than in 1939—Britain's Agricultural leaders are planning how to protect her corn crops from Nazi fire bombs.

Last year Germany's air onslaught did not develop fully until the harvest was gathered in, but this year, combined with U-boat attacks on shipping, the menace to British food supplies is very real.

Among the safeguards which may be enforced is the cutting of fire-breaks or lanes, about 30 ft. wide, across the direction of the prevailing wind. The crops, cut green, would not be wasted, but made into hay or silage. Corn stooks can be protected by setting the rows as far apart as possible. Ricks would be set at least 15 yards apart, and, preferably out in the field, to prevent enemy landings.

For dealing with outbreaks of fire, water carts would be kept filled near the standing crops, the further reserves stored in ricks or van covers supported on stakes.

Fire-fighters will arm themselves with stirrup pumps, fruit spraying machines, liquid manure carts, wet sacks and brooms cut from timber and hedgerows. Tractors will be useful for ploughing a fire-break quickly in the path of an advancing fire, and scythes for isolating small patches.

With fire watchers, A. R. P. wardens and Home Guards in every parish, there will be no lack of man-power to safeguard the vital harvest of 1941.

[We are grateful to Mr. Robert Williamson, Industrial Publicity Unit, Mowbray House, Norfolk Street, London, for forwarding this note for publication. *Ed. M. A. J.*]

Correspondence.

To

The Editor, Madras Agricultural Journal.

Silt Clearance.

Sir,

Of the numerous hardships to which the poor cultivator is subject, silt-clearance is one of no small magnitude. It is well known that as years pass on, tanks and their feeding channels get silted up. As a result of such silting up the capacity of the tank decreases while the *ayacut* goes on increasing and this leads to water scarcity. Thus water stored in some tanks is found to be inadequate for irrigating the fields. These tanks require more than two fillings, before the crops raised there are harvested, because of the tanks getting silted up. When there are plenty of rains, it is easy to store water as many times as are required. But during periods when drought is experienced, the subsequent fillings are not at all possible and the ryot is therefore hard hit.

Clearance of silt is now allowed to be done by the cultivators themselves, subject to certain rules, for preserving the tank from getting spoilt. The average cultivator, who is illiterate, cannot be expected to observe all the regulations framed by the Revenue Department and naturally he does not care to trouble himself with the silt which is indeed a very rich manure for his fields. I would therefore suggest that periodical silt-clearance should be effected by the Revenue Department itself and the silt cleared might be sold at nominal cost to the cultivators of the *ayacut*. This will greatly relieve him of unnecessary hardship.

There should be periodical inspection of tanks, at least once in every five years or at earlier intervals if possible, to investigate the conditions of the tanks as to whether the capacity of the tank remains undiminished and whether the water stored therein would be adequate to irrigate the *ayacut*. If these suggestions are put into effect, I am certain that the agriculturist in normal times would no longer be faced with a crop-failure, due to scarcity of water.

New House, Ilanji,
Tenkasi (Tinnevelly Dt.)

Yours etc.
I. S. Kuttalalingam Pillai.

Mofussil News and Notes.

Horticultural Show, Kumbakonam. A Horticultural exhibition on a fairly large scale was held at Kumbakonam during the closing days of June 1941. It was organised by a very influential Committee with Mr. P. S. Viswanathan, I. C. S., Sub-Collector of Kumbakonam as its President and Rao Saheb Sri C. R. Lakshmivaraha Iyengar and Rao Saheb Sri A. Ramadas as Joint Secretaries. There was a very good collection of mangoes of different varieties, sapotas, limes, oranges, plantains, coconuts, vegetables and flower and vegetable seeds produced by private growers in the district, besides a fine display of graft mango plants, ferns, crotons and a variety of other seedlings exhibited by the owner of the South Indian Lakshmi Nurseries in whose garden the Show was

held. The Departmental exhibits included graft plants, seedlings, root crops, vegetables, fruits and fruit products, like lime and lemon quashes and *kumquats* from Kodur, collection of cut flowers and varieties of potatoes from Ootacamund, sprayers and dusters with different varieties of chemicals used against fruit pests and diseases, with specimen boxes containing insects and fungi injurious to orchards. Specimen crops of different kinds of green manures were also grown in the grounds of the exhibition. Demonstrations of various implements and tools indispensable to orchard owners, preparation of leaf mould, Indore compost and the proper collection and preservation of cattle manure including urine, were held on all the days. The Director of Horticulture, Mysore State was kind enough to depute a Horticultural Inspector with a variety of fruits and fruit products for the exhibition and with a Domestic Fruit Canning set for demonstration. The demonstration of this canning set in the preparation and preservation of fruit juices, jellies and sliced fruits in sugar syrup was highly appreciated by the visitors to the show. The Agricultural Department of Pudukottah State also deputed an Agricultural Inspector with a collection of mango and other fruits produced in the State. The Director of the Nutrition Research Institute, Coonoor, was kind enough to send half a dozen illustrated and word posters on the value of different cereals, pulses, vegetables, fruits, milk and milk products in the diet of the nation. The Health Department of the Kumbakonam Municipality besides exhibiting valuable health charts and models exhibited samples of slaughter house manure, the compost prepared from night soil and municipal rubbish. Messrs. Pocha & Sons., Poona, sent their collection of different vegetable and flower seeds, besides a complete set of tools used in orchard practice. The Civil Asst. Surgeon in charge of the Govt. Hospital, Kumbakonam and the Health Officer, Kumbakonam Municipality, gave lectures on 'the value of fruits and vegetables in human diet' and the District Agricultural Officer, Tanjore, on 'How to start and maintain orchards'. Certificates of merit were awarded for notable exhibits. M. A.

Agricultural Exhibition, Virdhachalam. An Agricultural Exhibition on a small scale was conducted at Virdhachalam from the 26th to 28th July 1941 during the Tiru Adipuram festival. Different departmental paddy strains, green manure seeds and crops raised in pots, oilseeds and coconut seedlings from Nileshwar, improved implements and posters on all crops were exhibited at the stall. Nearly 4,000 visitors who were mostly agriculturists visited the stall and evinced keen interest. The pupils of all classes of the District Board High School (Elementary Section) accompanied by their respective teachers visited the stall in batches, and lectures about bee-keeping, manure preservation in pits were given to them by the local Agricultural Demonstrator. During the Exhibition 39 lb. of cotton seeds, 14 lb. of Daincha seeds, 842 lb. of improved paddy strains and 25 coconut seedlings from Nileshwar were sold. —A. D., Virdhachalam.

Retirement. Sri K. Kunhisankaran Nair, L. Ag., Farm manager, Central Farm, Trichur, has retired from service. He is an old boy of our College. He entered the State service, when the Cochin Agricultural Department was first formed and was one of those that were mainly responsible for the establishment and the subsequent development of the Central Farm, Trichur. We wish him a happy retired life. *Ed. M. A. J.*

Crop and Trade Reports.

Statistics—Crop—Sugarcane—1941—First report. The average of the areas under sugarcane in the Madras Province during the five years ending 1939-40 has represented 2·9 per cent. of the total area under sugarcane in India.

The area under sugarcane up to 25th July 1941 is estimated at 90,720 acres. When compared with the area of 129,720 acres estimated for the corresponding

period of last year, it reveals a decrease of 30·1 per cent. The estimated area is the same as that of last year in Kurnool, Tinnevelly and Malabar. An increase in area is revealed in East Godavari and South Kanara and a decrease in area in the other districts owing to the low price of jaggery at the time of planting. The decrease is marked in Vizagapatam (–3,000 acres), Kistna (–3,600 acres), Bellary (–4,200 acres), South Arcot (–9,000 acres) and the Central districts (–16,500 acres).

The condition of the crop is satisfactory except in Anantapur and North Arcot where the crop was affected by drought to some extent.

The wholesale price of jaggery per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 4th August 1941 was Rs. 6–10–0 in Mangalore, Rs. 4—15—0 in Adoni, Rs. 4—11—0 in Trichinopoly, Rs 4—7—0 in Vellore, Rs. 4—4—0 in Cuddalore, Rs. 4—2—0 in Cocanada, Rajahmundry and Chittoor, Rs. 3—11—0 in Vizagapatam, Rs. 3—7—0 in Vizianagaram, Rs. 3–5—0 in Salem and Coimbatore and Rs. 3—4—0 in Bellary. When compared with the prices published in the forecast report issued at this time last year, these prices reveal a rise of approximately 44 per cent. in Trichinopoly, 20 per cent. in Adoni, 16 per cent. in Mangalore, eight per cent. in Vellore and two per cent. in Vizagapatam and a fall of approximately 37 per cent. in Salem, 29 per cent. in Vizianagaram, 16 per cent. in Rajahmundry, 15 per cent. in Coimbatore, 14 per cent. in Cuddalore, 11 per cent. in Cocanada, five per cent. in Bellary, and four per cent. in Chittoor.

Statistics—Crop—Groundnut--1941--Second report. *Summer crop—Area and yield.* The area under the summer or irrigated crop of groundnut in parts of the Madras Province during the five months—January to May 1941—is estimated at 65,300 acres as against 120,300 acres estimated for the corresponding period of last year, representing a decrease of 45·7 per cent. The decrease is due to (i) want of timely sowing rains, (ii) propaganda for the restriction of groundnut cultivation and (iii) the low price of groundnut at the time of sowing. The crop suffered from drought to some extent in South Arcot, Chittoor, North Arcot and Tanjore. The harvest of the crop is in progress. The yield per acre is expected to be normal in all districts except South Arcot, Chittoor, North Arcot and Tanjore. The total yield is estimated at 50,600 tons of unshelled nuts as against 100,100 tons estimated for the corresponding period of last year, representing a decrease of 49·5 per cent.

Early crop—Area and yield. The area under the early crop of groundnut (mostly unirrigated) up to 25th July 1941 in the districts of Salem and Coimbatore is estimated at 105,000 acres. When compared with the area of 153,000 acres estimated for the corresponding period of last year, it reveals a decrease of 31·4 per cent. owing to the late receipt of sowing rains, especially in Salem. The yield per acre is expected to be normal in both the districts. The yield in these two districts is estimated at 52,500 tons of unshelled nuts as against 76,500 tons estimated for the corresponding period of last year, representing the same decrease as in the case of acreage namely 31·4 per cent.

The wholesale price of groundnut (machine shelled) per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important market centres on 4th August 1941 was Rs. 5—12—0 in Guntakal, Rs. 5—2—0 in Vellore, Rs. 4—14—0 in Vizianagaram, Guntur and Cuddalore, Rs. 4—11—0 in Vizagapatam, Rs. 4—10—0 in Cuddapah, Rs. 4—7—0 in Tadpatri, Rs. 4—5—0 in Adoni, Rs. 4—4—0 in Hindupur, Rs. 4—1—0 in Bellary, Rs. 4—0—0 in Salem and Rs. 3—7—0 in Nandyal. When compared with the prices published in the last report, i. e. those which prevailed on 7th July 1941, these prices reveal a rise of approximately 51 per cent.

in Tadpatri, 37 per cent. in Vellore, 31 per cent. in Hindupur, 30 per cent. in Adoni, 25 per cent. in Cuddapah, 24 per cent. in Guntur, 23 per cent. in Bellary, 20 per cent. in Nandyal, 18 per cent. in Vizianagaram and Cuddalore, 16 per cent. in Salem and 10 per cent. in Vizagapatam.

Statistics--Crop—Gingelly—1941-42—First forecast report. The average of the areas under gingelly in the Madras Province during the five years ending 1939-40 has represented 15·8 per cent. of the total area under gingelly in India.

Area. The area under gingelly up to 25th July 1941 is estimated at 281,800 acres as against 344,200 acres estimated for the corresponding period of last year. The estimated area is the same as that of last year in South Kanara; an increase in area is revealed in the Circars (Guntur excepted), Bellary and Malabar and a decrease in area in the other districts owing to want of timely sowing rains. The variations are marked in Vizagapatam (+10,000 acres), South Arcot (-10,000 acres), North Arcot (-20,000 acres), Salem (-16,000 acres) and Coimbatore (-17,000 acres).

Yield. The crop suffered from drought to some extent in Guntur, Chingleput North Arcot, Salem, Ramnad and Tinnevelly. The yield per acre is expected to be generally normal in the other districts.

The wholesale price of gingelly per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 4th August 1941 was Rs. 7—1—0 in Trichinopoly, Rs. 7—0—0 in Cocanada, Rs. 6—12—0 in Tinnevelly, Rs. 6—7—0 in Cuddalore, Rs. 6—6—0 in Tuticorin, Rs. 6—3—0 in Ellore, Rs. 6-1-0 in Salem, Rs. 6—0—0 in Vizianagaram, Rs. 5—14—0 in Vizagapatam and Rs. 5—11—0 in Rajahmundry. When compared with the prices published in the report for the corresponding period of the previous year, i. e., those which prevailed on 5th August 1940, these prices reveal a rise of approximately five per cent. in Salem and a fall of approximately 12 per cent. in Rajahmundry and Tuticorin, 11 per cent. in Vizianagaram and Ellore, ten per cent. in Cuddalore, seven per cent. in Tinnevelly, three per cent. in Trichinopoly and two per cent. in Vizagapatam, the price remaining stationary in Cocanada.

Statistics—Cotton—1941—42—First Forecast Report. The average of the areas under cotton in the Madras Province during the five years ending 1939-40 has represented 9·7 per cent of the total area under cotton in India.

The area under cotton up to 25th July 1941 is estimated at 167,200 acres. When compared with the area of 235,100 acres estimated for the corresponding period of last year, it reveals a decrease of 28·9 per cent.

Central districts and South—Mainly Cambodia tract. The area in the Central districts and the South represents generally the last year's crop left on the ground for second pickings before the plants are removed in September in compliance with the provisions of the Pest Act. The area in these districts fell slightly from 146,100 acres to 143,300 acres. The yield is expected to be generally fair.

Westerns tract. The area under Westerns fell from 61,300 areas to 9,200 acres i. e., by 85·0 per cent. The decrease in area in the current year is due to the poor rains received in June and July.

White and Red Northerns tract. The area under White and Red Northerns also fell from 13,500 acres to 1,700 acres i. e., by 87·4 per cent.

Warangal and Cocanadas tract. The area under Warangal and Cocanadas cotton fell from 8,200 acres to 7,000 acres i. e., by 14·6 per cent.

The average wholesale prices of cotton lint per imperial maund of 82$\frac{2}{7}$ lb. as reported from important markets on 4th August 1941 was Rs. 16–7—0 for Cocanadas, Rs. 20—9—0 for White Northerns, Rs. 18—2—0 for Red Northerns Rs. 16—8—0 for Westerns (Mungari crop), Rs. 22—0—0 for Westerns, (Jowari crop), Rs. 42—8—0 for Coimbatore Cambodia, Rs. 31–4—0 for Southern Cambodia Rs. 36—9—0 for Coimbatore Karunganni, Rs. 29—4—0 for Tinnevellies and Rs. 30—3—0 for Nadam cotton. *(Director of Industries and Commerce.)*

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 15th August 1941 amounted to 505,569 bales of 400 lb. lint as against an estimate of 503,500 bales of the total crop of 1940–41. The receipts in the corresponding period of the previous year were 398,480 bales. 434,455 bales mainly of pressed cotton were received at spinning mills and 57,389 bales were exported by sea while 93,113 bales were imported by sea mainly from Karachi and Bombay.

(Director of Agriculture.)

College and Estate News.

Students' Corner. The inaugural address of the Students' Club for the year was delivered on the 3rd of August 1941, by Sri Rao Saheb Venugopal Pillai, B. A., B. L., Advocate, Coimbatore, with R. C. Broadfoot Esq., Principal, in the chair. The lecturer touched on the greatness of India's cultural heritage and exhorted the students to be worthy of it. The lecture was concluded with an appeal for help in the present war efforts, at the same time praying for the success of the Allies.

An emergency meeting was held on 7—8—1941 with Sri L. S. Subrahmaniam, Assistant Sugarcane Mycologist, in the chair to record the deep feeling of sorrow on the passing away of India's greatest poet Dr. Rabindranath Tagore and to convey heartfelt sympathy to the bereaved members of the family. Friday, the 8th of August, was declared half holiday by the Principal as a mark of respect to the memory of the poet.

A lecture on the "Art of speaking" was delivered on 13—8—1941 under the auspices of the Students' Club by Sri T. V. Srinivasaraghavachariar, B. A., retired Deputy Superintendent of Police, with Sri R. S. Sankara Iyer, B. A., B. L., retired District and Sessions Judge, Coimbatore, as the President. The lecture was both interesting and humorous.

Games: *Cricket.* A friendly match was played between the College and the local Government Arts College on the 10th of August and another on 16—8—41 between the College and the Stanes High School. On the latter occasion, B. S. Krishnan of the College scored 104 not out. We offer our congratulations to him. A third match was played on the 17th with the local S. R. C. Club which ended in a draw.

Hockey. On the 15th the College played a friendly match with the Stanes High School, and was defeated by three goals to nil.

The Association of Economic Biologists, Coimbatore. The Annual meeting of the above Association was held on the 16th August 1941, in the Agricultural Lecture Hall of the Freeman Building with Sri. M. C. Cherian, President, in the chair.

The minutes of the last annual meeting were read by the Secretary, Dr. S. Kasinatha Iyer, and adopted by the General Body. The annual report for 40-41 and budget for 1941-42 were read and adopted.

The following office bearers were elected for the year 1941-42.

Sri Rao Babadur V. Ramanatha Ayyar—President.
,, N L. Dutt —Vice President.
Dr. J. S. Patel —Mofussil Vice President.
,, S. Kasinatha Iyer —Secretary.
Sri. C. S. Krishnaswami —Assistant Secretary.
Mr. C. M. John & Dr. N. Parthasarathy—Members of the Executive Council.

Sri. Rao Bahadur V. Ramanatha Ayyar proposed a vote of thanks to the retiring committee.

The President delivered an address on "Some important sugarcane pests of the world," illustrated by lantern slides.

St. John's Ambulance Brigade. A batch of about 60 students of the Agricultural College are taking the course on First Aid. The classes were inaugurated by Mr. R. C. Broadfoot, Principal, Agricultural College, on 24th July 1941, when he exhorted the students to master this subject which will be very useful to them in their later life. Dr. K. Narayanan, Divisional Surgeon, is lecturing on First Aid twice a week, on Mondays and Fridays.

A demonstration of First Aid practices was given on the 14th August 1941 by the Brigade in connection with the distribution of First Aid certificates to 49 candidates. The full strength of the Brigade was in attendance and there was also a march past and a few items of infantry drill. Mr. R. C. Broadfoot who distributed the certificates congratulated the Brigade members on their excellent performance and expressed the hope that the Brigade would go up from strength to strength.

Scouting. In addition to Rao Bahadur G. N. Rangaswamy Ayyangar who is already a member of the Coimbatore District Scout Council, the following officers of the Agricultural College and Research Institute have also been co-opted as members at a meeting of the Council held on 2nd August 1941: Mr. R. C. Broadfoot, Mr. C. M. John and Mr. R. Ratnam.

It is understood that the scout movement on the College Estate is being revived. An appeal to Estate residents to admit their boys into the Ramakrishna Scout Troup has been issued.

M. A. S. U. Editorial Board. At a meeting of the Board held on 5th August 1941, Dr. N. Krishnaswamy, who was elected to the Board in place of Mr. K. M. Thomas resigned, was elected Sub-Editor.

Visitors. Sri T. Budhavideya Rao Naidu, Headquarters Deputy Director of Agriculture, Sri Rao Bahadur Y. Ramachandra Rao, Locust Entomologist and Sri. K. Ramiah, M. B. E., Geneticist, Institute of Plant Industry, Indore, were among the visitors to the Agricultural College and Research Institute during the month.

Departmental Notifications.

Gazetted Service.

Appointments.

Sri. K. C. Naik, Superintendent, A. R. S. Anakapalle working as temporary Superintendent, Fruit Research Station, Koduru, is appointed to act as Fruit Specialist, Koduru, with effect from the date of his taking charge.

Dr. A. Subba Rao, Soil Physicist, Dry Farming Station, Hagari, will continue to hold full additional charge of the post of Superintendent, Dry Farming Station, Hagari, during the absence of Sri. P. Krishna Rao.

Leave.

Sri. P. Krishna Rao, Superintendent, Dry Farming Station, Hagari, extension of l. a. p. for 6 weeks from 6—8 -41.

Postings and Transfers.

Saadat-ul-lah Khan Sahib Bahadur, Deputy Director of Agriculture, on return from leave, to be Deputy Director of Agriculture, Cocanada.

Sri. P. Subrahmanyan, offg. D. A. O. Saidapet, on relief by Sri. M. Subrahmanyan Pillai to officiate as D. A. O, Ellore

Sri. A. Gopalan Nayar, offg. D. A. O. Tinnevelly, on relief by Sri. M. A. Balakrishna Ayyar to officiate as D. A. O. Calicut.

Samuel Jobitha Raj, offg D. A. O. Calicut, on relief by Sri. A. Gopalan Nayar to officiate as D. A. O. Madura.

Sri. K. Venkatarama Ayyar, D. A. O. Cuddalore, on relief by Sri. T. G. Muthuswami Ayyar to be D. A. O. Cuddapah.

Sri. R. N. K. Sundaram, D. A. O. Cuddapah, on relief by Sri, K. Venkatarama Ayyar to be D. A. O. Bellary.

Subordinate Service.

1. Appointment.

A. Mohammad Ali Sahib, Agricultural Demonstrator, Puttur, in the new I Grade of Rs. 145—5/2—190 is appointed as temporary Horticultural Assistant, Fruit Research Station, Koduru to be in charge of the research work connected with the Imperial Council of Agricultural Research Scheme under the supervision of the Fruit Specialist.

2. Transfers.

Name of officers	From	To
Sri. K. Satyanarayanamurthi,	Offg. Asst. Cotton Scheme, Adoni;	Offg. Asst. C. B. S. Coimbatore.
„ N. G. Narayanan,	Asst. C. B. S. Coimbatore;	A. R. S. Nandyal.
Janab Gulam Ahmed Sahib	F. M. A. R. S. Koilpatti;	A. D. Venkatagiri.
Sri. P. Sudarsanam Nayudu,	Foreign service, Tobacco Market Committee, Guntur,	F. M. A. R. S. Guntur,

„ G. Kameswara Rao,	F. M. A. R. S. Guntur;	F. M. A. R. S. Anakapalle
„ K. K. Raghavan.	A. D. Conjeevaram;	F. M. A. R. S. Koilpatti.
„ K. K. Subrahmanya Ayyar,	A. D. Devakottai;	A. D. Conjeevaram.
„ Herbert Adiseshiah,	A. D. under training, Sugarcane Station, Gudiyattam;	A. D. Palamaneir.
„ V. G. Venkataramana Rao,	A. D. Palamaneir;	A. D. Kalahasti.
„ K. S. Ramana Rai,	A. D. Kudligi;	A. D. Harpanahalli.

3. Leave.

Name of officers.	Period of leave.
Sri B. V. Ramana, A. A. D. Tuni,	L a. p. for 1 month from 5—8—41.
„ T. V. Srinivasa Charlu, A. A. D. Ambasamudram,	Extension of l. a. p. for 1 month on m. c. from 23—7—41.
„ C. S. Namasivayam Pillai, A. A. D. (on leave),	Extension of leave on half average pay on m. c. for 10 weeks from 19—5—41.
„ P. Lakshminarayana, A. A. D. Chodavaram,	Extension of l. a. p. on m. c. for 1 month from 30—7—41.
„ G. Duraswami, F. M. A. R. S. Koilpatti,	L. a. p. for 31 days from the date of relief.
„ M. R. Balakrishnan, Assistant, A. R. S. Siruguppa,	L. a. p. for 4 months from 4—7—41.
„ K. Sitarama Ayyar, F. M. A. R. S. Pattukottai	Extension of l. a. p. on m. c. for 1 month from 23-7-41.
„ V. Chidambaram Pillai, A. D. Sankarankoil,	L. a. p. on m. c. for 1 month from 29-7-41.
„ N. Annaswami, A. D. Giddalur,	L. a. p. for 1 month and 3 days from 28-7-41.
„ M. Vaidyanatha Ayyar, A. D. Madakasira,	L. a. p. on m. c. for 6 weeks from 6-7-41.
„ N. Krishna Pillai, A. D. Pollachi,	L. a. p. for 1 month and 6 days from 25-8-41.
„ D. Bapayya, Tobacco Market Committee, Guntur.	L. a. p. for 1 month from 13-8-41.
„ B. W. X. Ponnaiya, Assistant, Millets Section, Coimbatore,	L. a. p. for 32 days from 27-8-41.

Postings and Transfers.

Sri. R. H. Krishnan, temporary Assistant in Millets, D. F. S. Hagari to be Librarian, Agricultural College, Coimbatore.

Sri. D. Rama Rao, is reappointed as Upper Subordinate in the Science section and is posted to officiate as Temporary Assistant in Millets, D. F. S. Hagari.

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EDITORIAL

Vegetable Dyes. Time was when vegetable dyes played a very important part in human economics, but once the synthetic aniline dyes entered the market, they lost their value. The time is now opportune again for the resuscitation of the vegetable dyes for two reasons. Owing to the war the import of artificial aniline dyes are very irregular and inadequate, and consequently the stock is getting practically almost exhausted. Secondly, the little stock that is available is very prohibitively costly. Under these circumstances it behoves us to think of starting growing again such of those valuable plants which were, in the pre-aniline days, supplying the needs of this important industry. The first place must of course be given to the once familiar Indigo plant—*Indigofera anil* Linn. (*I. Sumatrana* Gaertn.), popularly known as *Neli* in Tamil and Telugu and as *Neelam* in Malayalam. There was a time when this crop was cultivated as largely as any other commercial crop of today. It is still grown in some parts, but often, only as a green manure and soil improving crop, belonging as it does to the family Papilionacae whose members are of these values *I. tinctoria*, wild indigo, also yields very good dye like the former species. There are a number of other plants easy of cultivation which yield dyes. *Carthamus tinctorius* Linn., the safflower, wild or Bastard saffron, African or American saffron and carthamine dye is another familiarly cultivated plant grown more for the sake of its oil than for its dye. But the present situation in the dye industry calls for the use of its florets which yield a beautiful yellow dye which is used in colouring silk and wool. The well known turmeric plant *Curcuma longa* Roxb. yields an excellent yellow dye. *Bixa orellana* Linn. the Annatto, *Jaffra maram* (Tamil), *Jaffra chettu* (Telugu) is a small tree growing both wild and cultivated in the West Coast and Circars. This yields an orange dye which is used for colouring cheese, yarn, etc. Another very valuable dye yielder is *Mallotus philippensis* M. Arg. the Kamala dye plant. It is popularly known as the Monkey face tree in English, *Kamela* in Tamil and *Kunkuma* in Telugu, a tree found in all forests of the Northern Circars, Deccan and Western ghats. The glandular pubescence of the fruit yields a rich orange red permanent dye known as Kamela dye. The extract prepared with soda imparts to silk a fine and durable fiery orange colour without further addition or the use of mordants. *Artocarpus integrifolia* Linn. the jak, yields an yellow dye obtained from its heart wood; the wild trees of Rubiaceae, *Morinda tinctoria* Roxb. and *M. citrifolia* Linn. are rich in a red dye easily obtained from their wood, bark and root bark.

In fact there is no dearth of material, as there are a number of plants of the plains as well as of the forests some of which are already in cultivation such as the safflower, the jak and the indigo for other needs, but which could be more largely cultivated now to meet the needs of the dye industry. One must be able to fit his local supply of dyes as almost all the indigenous dye plants are scattered all over the Province. The time is opportune for any enthusiast in the line to revive the industry of vegetable dyes, in which he is sure to have all the help he requires easily given to him as the case may be from the Agricultural, the Forest or the Industries Department.

Convocation Address. On the 15th of August 1941, the Rev. L. D. Murphy, S. J., M. A., Principal, Loyola College, Madras, delivered the Convocation Address to the graduates admitted to degrees at the 83rd Convocation of the Senate of the University of Madras. In the course of his very inspiring address, the learned professor remarked. "And here our educational system is at fault. The high school ends too early, and the system makes no provision for those who wish to continue their studies without entering a University. We need a great number of technical schools under Government management to round off the school course, so that when Matriculates go to the University, the others may go to a specialised course in book-keeping, type-writing and shorthand, or a specialised course in draughtsmanship or in electricity or automobile engineering. This kind of vocational training would go a long way to meet the case of those 20,000 students who annually pass the S. S. L. C. and do not enter the University. Above all we need more *Agricultural* and *Veterinary* Colleges. Tremendous strides have been made within the last few decades in the improvement of all manner of seeds, in the improvement of all manner of cattle stock, in the diagnosing and curing of plant and cattle disease; but as yet it is on all too small a scale. The riches of India lie here and over 100 millions of its people are engaged in agriculture, but things are only being slowly worked up, because the people will give themselves up to a cultural literary education instead of an agricultural and veterinary one." No one can gainsay the truth of the statements made here. Admittedly India is mainly an agricultural country and it is true over 100 millions of its people are engaged in agriculture. It is time more and more of these 100 millions, if not all the 100 millions, are trained in modern agricultural methods. Now that there is a cry everywhere that we must produce more food crops than ever before, and what is more, good quality crops also, the need for imparting agricultural education to the masses has never been so important as today. Agricultural and Veterinary schools should therefore be multiplied, and what is wanted is not colleges of the type of the Agricultural and Veterinary colleges run and maintained at rather heavy expense, but smaller schools where those who leave the schools and have no other avenues of life open to them except agriculture, can gather and learn actual farming on modern lines.

Nagari Oranges—Their past and present.*

By A. MUHAMMAD ALI, B. Sc. (Ag.),
Agricultural Demonstrator, Puttur.

Introduction. *Nagaram* and *nagari* orange, are other names for the *sathugudi* or the *chinee* orange. These names are derived from its original home—Karvetnagar town, popularly known as "Nagaram", the capital of the Karvetnagar zamindari. The famous *Khasa* (private) garden of the Rajah of Karvetnagar, was once reputed in the whole of the central districts, for the finest quality of *chinee* fruits it produced. All the trees, found in the original Karvetnagar zamindari, now comprising the revenue taluks of Tirutani and Puttur of the Chittoor district, are the descendants of those in the *khasa* garden. It is possible, that the *chinee* oranges found in the rest of the Chittoor district and the adjoining districts of Cuddapah and North Arcot, also claim their descent from the reputed original stock in the *Khasa* orchard. With the decline of the zamindari the *khasa* garden too gradually disappeared, and to-day not even a single *chinee* tree remains there to commemorate the origin, spread and history of the famous *sathugudi* orange of the Ceded districts. No record is also available to establish clearly, as to from where and how, this orange, first found its way to the *Khasa* garden. One theory has it, that, the fruit was first introduced into Palacole in N. Circars by the Dutch settlers and from there a few trees might have been introduced into Karvetnagar, by an enterprising zamindar.

Even after the disappearance of the *Khasa* garden, the Karvetnagar *chinee* fruits continued to enjoy a reputation for quality in the South Indian markets and they used to be sold at a premium in the Madras city. Inspite of this encouragement, paradoxically enough, the area under this has gradually declined in and around Karvetnagar town during the last few years. In this note an attempt is made to summarise the several uneconomic and bad orchard practices, which are believed to have been primarily responsible for the present restriction of the area under this fruit, almost to a stage of its wholesale elimination.

Soil. Tempted by good returns in the past, the *ryots* undertook, for a time, to extend the area under *chinee* cultivation in all kinds of soil with disastrous consequences for themselves and to the future of the *sathugudi* industry itself in this tract. In places where the soils were shallow with a hard subsoil layer, the trees continued their normal growth for about 10 to 15 years. Just when the yield should be normal the hard sub-soil layer began to tell upon the growth of the plant adversely and gradually the trees weakened, diseases like 'the die-back,' 'gummosis' etc. appeared and instead of the anticipated good yield, an unsightly and uneconomic orchard presented itself. In some places, the orchards were established in

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low-lying lands with a high water table. Here again the result was equally disastrous and disappointing. The planting of the trees in loose soils with poor humus content was yet another defect which brought about the premature ruin of the *chinee* orange industry. In such soil, the growth was very poor, and after sometime the orchard had to be necessarily abandoned or grubbed out to make room for other agricultural crops.

Spacing. Normally orange plants are known to require an optimum spacing of about thirty feet for their full development and profitable performance. Strangely enough, the spacing adopted in most orchards in this tract was not more than eighteen feet, with the result the trees grew tall and lanky, with inadequate room for branch spread and consequent reduction of the bearing area to a considerable extent. In old orchards the roots had to crowd themselves in a limited zone. Thus cramped for space and artificially hindered in growth, the trees naturally declined in vigour and productivity at a very fast pace, becoming a liability to the owners.

Methods of propagation. Propagation by seedlings was the only method adopted in this tract. Whatever might be the care exercised in the selection of the parent tree, the seedling offsprings can never be relied upon to have the same character as the parent. Uneconomic bearing of an amazingly large number of trees and periodic crop failures are attributed to this method of propagation by seed. It is natural, therefore, that the interest of the grower very soon faded when most of his trees failed to produce profitable crops resulting in an increasing number of neglected orchards.

Orchard practices. Cultural: In the successful farming of fruits, careful cultural and pruning practices play a very important role. But the Nagaram grower of *sathugudi* rarely recognises or understands these essential principles. After the trees are planted they are left to themselves, except for an occasional ploughing to clear weeds during the flowering season and some irregular irrigation. Rank weed growth, in most orchards, shows that even the necessity for the removal of these do not engage the serious attention of the ryots.

Pruning. The trees are seldom pruned, and the presence of a mass of dead wood on the trees is a common sight in the majority of orchards. The neglect to prune off dead-wood in time often results in poor new growth and death of a greater number of twigs and the consequent lowering of yields. Too many orchards have been ruined by this neglect to attend to the needs of the trees in good time.

Root pruning. Root pruning is another injurious practice, that has brought ruin to a number of ryots. In a normal, but a shy bearing plantation root pruning usually forces yield for the first time. Encouraged by such visual results obtained in the first instance, the practice of root-pruning, was widely adopted, as an annual orchard practice, with the result that the yield was gradually reduced to practically nothing. The worst effect of this evil practice was very markedly felt in the case of one ryot in the Tirumandriyam

village of the Puttur taluk. Innocently falling a victim to an evil advice, he resorted to root pruning. Very soon, his trees became affected in a severe form by gummosis and the die-back diseases, and his orchard of 50 trees presented such a bad appearance that in 1938 he resolved to cut them down and release the area for agricultural purposes. Just then, the Agricultural Department came to his aid and by a carefully planned programme of treatment, the diseases were brought under control and gradually the yield too increased. In the year 1940 he was offered Rs. 600 for his crop. Unfortunately, with the gradual increase in yields, he forgot the previous history of his plantation or failed to realise adequately the harmful effects of his forcing methods for increasing fruit crop. During August last he once again resorted to root pruning. He dug deep round the plants, removed earth, dumped in green leaves and other nitrogenous manures and covered them with earth. In a few days, the good looking trees suddenly turned pale, immature fruits began to fall and his entire orchard relapsed to its original miserable condition. The flowering was practically nil in January last and today, he has become a wiser man and has learnt fully the evil effects of root pruning, though at the expense of his trees.

Irrigation. Most of the gardeners do not seem to know the proper method of irrigating the trees. They form small shallow basins round the trees and irrigate them sparingly but rather constantly. And the bulk of the space between the plants, where tender functioning roots are present, is left unirrigated. So much so, the plant growth is very much restricted for want of adequate quantity of water and the yield is reduced. Further, owing to the water constantly touching the stem diseases of the bark have appeared.

Another common defect observed is the abnormal postponement of the first irrigation for the year. Normally, the *chinee* trees flower in the last week of January. If proper *angam* (local) flowering is to be ensured it is necessary that the orchard should be given the first irrigation almost at that time. Unfortunately, this is seldom done. It is not uncommon to find the trees being irrigated as late as the end of February. Once the timely irrigation is not given the vegetative and the flower bud formation get impeded and the result is poor flowering. This phenomena is very commonly observed in this tract, due to the failure to irrigate the plants in time.

Manuring. Except sheep penning, no other manure is applied to the *chinee* trees. As a result of inadequate manuring, growth is diminished and the number and the size of fruits are found to be rather small.

Delayed harvest. With a view to secure high prices, the ryots have a tendency to delay the harvest. In most cases, picking is postponed to even as late as, the beginning of January. When the crop is kept on for long, the period of rest that is so very essential is either lost or minimised. Consequently the flowering in the next season is reduced. In their eagerness to obtain the best price for the crop the ryots forget the natural repercussions on the tree due to this delay and thereby help for a progressive deterioration in tree yields.

Diseases. The gardeners do not seem to have sufficiently understood the evil effects of gummosis It is a common sight to see trees die suddenly in the orchards. When the gum exudation commences, they ignore its appearance and it is only when the whole bark has been separated and the plant is dead, that the gardeners are attracted. 'Die-back' is another serious disease, which levies a heavy toll in Nagaram town. No precautions or remedies are being taken to keep this scourge within bounds or to root it out.

One ryot, a fairly important orange grower of the Keelampakkam village, who owns a garden of nearly 500 trees practised a very novel method in December 1940. He flooded the whole garden, ploughed it in puddle, spread indigo leaves, trampled them in and allowed the garden to dry up. At the end of February he commenced irrigation, with high hopes of getting a bumper crop. To his great distress neither there was adequate fresh growth nor flowering. In a few months, dead wood appeared and every tree was badly affected by gummosis and die-back. Having spoilt the condition of his trees he sought the help of the Agricultural Department when it was explained to him that his ploughing in puddle and trampling in of the green leaves, had not only disturbed the roots but had badly pruned them. Further the soil too had become hard. Hence the appearance of the diseases.

The General impressions in the tract. Owing to the several causes enumerated there are by far a greater number of uneconomic than economic orchards in this tract. A number of gardeners have wasted their fortune on raising, the up keep and the maintenance of orchards till they attained the bearing stage all the while hoping that after 10—12 years the orchard would become a paying proposition. Unfortunately, due to defective orcharding, the result was quite the reverse. Instead of good looking, well shaped, healthy trees, ill shaped, diseased plants presented themselves, and the return was far below their expectations Once the orchard was found to be uneconomic, instead of trying to remedy the defects, the gardeners grew desperate and neglected them. Due to this a belief has been created in this tract, that 'one who goes in for *chinee* cultivation is sure to court ruin.'

Conclusion. As stated in the beginning itself, the idea in presenting this note is to place before the intending *chinee* growers the several major defects observed in the original home of this orange, so that they might guard themselves against practising the same either wittingly or unwittingly. The point naturally arises as to what are the best methods to be adopted if good orchards are to be raised and are to be kept in a profitable condition. Want of space limits the discussion of these obviously important points. For the present the growers are recommended to seek the aid of the nearest officer of the Agricultural Department and follow his advice. The writer is highly grateful to Sri. K. C. Naik, Superintendent Fruit Research Station, Kodur, who gave valuable suggestions and criticisms.

Some Promising Fruit Products of South India.*

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Owing to the spontaneous and unregulated fruit industry of this part of India, our commercial orchards produce an admixture of good, bad and indifferent quality fruits in varying proportions In almost every season the problem of disposal of the inferior quality or cull fruits is one of major importance to the fruit growers The stability and expansion of a profitable fruit farming industry is intimately connected with the profitable utilisation of a large part, if not all, of those fruits that have no value in our fresh fruit markets. It is true that preparation of home-made jams, dried mangoes and some kinds of pickles and chutneys are popular in several parts of the country, but these outlets cannot be expected to touch even the fringe of the problem of the utilisation of fruits.

Even in the matter of our superior quality fruits the development of a large-sized fruit-products industry is essential to off-set the uncertainties of price fluctuation in fresh fruit markets. The frequent occurrence of gluts and uneconomic price levels can only be relieved by either the extension or the improvement of market facilities, or by the conversion of a bulk of our fresh fruit produce into suitable by-products. The fruit products industry has contributed a very large share in the development of the fruit-growing industries in many parts of the world, and should, make a special appeal to fruit growers in this country also.

Marketing improvements can only be effective in the case of fruits of marketable value that are produced in abundance in a fairly compact area within easy access of transportation centres. In this country where orchards have sprung up at all odd corners, often in localities from where transport is difficult or very expensive and where production itself is extremely unstandardised, the extent of possible improvement through better marketing is but limited. The development of 'fruit products industry' is therefore of great importance in this country, if adequate returns for all the fruits produced are to reach the pockets of growers. Madras ranks very high among the fruit producing Provinces and States in India. We claim an area of about 250,000 acres under mangoes, about 150,000 under bananas, over 20,000 acres under citrus and a very large undetermined area under a host of cheaply and abundantly produced fruits like, custard apple, wild fig, etc. In the conversion of these fruits into fruit products lies obviously a profitable avenue for the future prosperity of our fruit-growing industry.

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During the past six years some preliminary work on the conversion of a number of commercially grown fruits into a variety of products has been in progress at the Fruit Research Station, Kodur. It is naturally to be expected that with a work that is of such a complex and prolonged nature, much results of practical value cannot accrue from these preliminary trials. Nevertheless some of the products manufactured on the station have been certified by a large number of independent observers to be of high quality and full of promise. The following is an account of the work carried out on some of the products which may be of interest to those who may venture to develop a profitable opening for at least a part of their fruit produce.

Lime products. Limes form one of the most extensively grown fruits in this province and are exported in considerable quantities to North Indian markets. The high transportation costs and the heavy seasonal productions often result in only unremunerative returns to lime growers, as a result of which the necessity for the development of lime products is clearly indicated. Work on the preparation of lime cordials and squashes, lime-peel powder and pickles has given encouraging results at Kodur. The cost of preparation of good quality lime beverage of about 12 oz. (without container) works to only Rs. 0—2—3, as against the sale price of similar imported products at Rs. 1—12—0 per 24 oz. (including container). These figures amply indicate the scope for the extended manufacture of these products. The most suitable method for preparation of lime beverages consists of bottling the juice with 65° Brix, with 200 parts of sulphur dioxide per million parts by weight, in sterilised containers after five minutes of exhaustion.

Vadlapudi orange. Vadlapudi orange is a fruit of some commercial importance particularly in Guntur and Kistna districts. Owing to its reputed dietetic value, it has enjoyed a fairly good market in the Circars for some years past. But the production has now reached to such a proportion that the problem of marketing these fruits profitably in other parts of the Presidency or the country is found to be acute, as taste for this fruit is not easily developed except in some parts of Circars. A palatable squash with 60° Brix preserved in 150 parts of sulphur dioxide per million by weight, and exhausted in the same way as for lime beverages, has been prepared at a cost of Re. 0—2—9 per 12 oz. The preparation of essential oils from the peels of these orange has also been attempted with some success, while Messrs. The India Fruits, Ltd. have manufactured some excellent marmalades from these fruits.

Chinee orange. Squashes and cordials from inferior quality *chinee* oranges have been prepared by adopting the same methods as referred to above and with the addition of some amount of lime juice in order to bring the acidity in the final product to about 2% in terms of citric acid. Preserved orange beverages are, however, notorious for rapid deterioration in quality under storage conditions, for preventing which de-aeration has been reported to be essential. The latter method remains yet to be tried.

Lemon Beverages. In point of flavour, lemon beverages are decidedly superior to those of limes. Although lemons are not cultivated on a commercial scale in this Presidency, the high productive nature of a number of varieties so far tried at Kodur together with the precocious habit and ability to produce fruits almost throughout the year, appear to mark out these lemons as full of promise. Trials on the preparation of squashes and cordials with fruits of several varieties of lemons, adopting the same methods as those described under limes, have also given very encouraging results.

Pineapple. The West Coast provides some of the ideal conditions for cultivation of pineapple at a cost which can bear comparison with any other part of the world. Simhachalam and some parts of the Circars and also Lower Pulnies are other areas where this fruit is found to thrive very well. Excellent products of canned pineapple, pineapple jam, pineapple squashes and pineapple candy have been prepared by employing the wellknown methods. But the cost of manufacture of these products at Kodur, several hundreds of miles away from production centres, becomes too high so that the manufacture of these does not seem to be a profitable proposition. There seems to be some scope for the establishment of a pineapple cannery in West Coast provided the cannery can command an assured and regular supply of suitable varieties. This is one of the crops in which the extension of the area and the development of canning factories are closely inter-dependent and are bound to be mutually benefitted. Of all the varieties so far tried the Kew has been found to be the most suitable for canning.

A small hand-made pineapple extractor for the removal of eyes expeditiously and with least wastage of edible matter and juice has been devised at Kodur and is now being sold by the Metal Industries, Shoranur. A small dehydrating chamber which can be heated with a special home-made oven and in which control of heat can be effected has also been devised and this renders the dehydration of fruits and preparation of candy very simple.

Mango. Although mango forms the leading commercially produced fruit of this Province no encouraging result in the canning of this fruit has so far been achieved. Several of our varieties are believed to be deficient in acidity, and therefore are difficult to be processed by the ordinary methods. The presence of turpenes tend to give an oil-flavour to the product and therefore devices have to be evolved to eliminate these in the final pack. Trials on canning of several of our wellknown commercial varieties like *neelum* and *bangalora* have proved a failure from the point of view of quality, although the products remained in sound condition inside the cans for even two years. *Manoranjan* and *baneshan* have shown to can slightly better, but even these cannot be said to be up to the mark. Messrs. India Fruits Ltd. have however succeeded in obtaining some good packs with *chinnasuvarnarekha* and some *rasam* varieties, particularly with *kothapallekobbari*. With dehydration, however, good success has been

obtained with several varieties and mango "leather" of good palatability and attractive appearance have been prepared. There is also a good prospect for the manufacture of several types of pickles and chutneys both on a cottage industry and factory scale.

Banana flour. By dehydration in the specially improvised chamber referred to previously, it has been possible to prepare flour from several varieties of bananas, of which some have appealed greatly to a number of independent observers. Mixed with milk and sugar the flour of *virupakshi* has been considered by several to provide an excellent food, possibly of very high dietetic value also. The flour of banana may also lend itself for the manufacture of a variety of foodstuffs like biscuits, bread and some special types of breakfast and invalid foods.

Papaya. To many, a fresh ripe papaya is distasteful, but in the papaya conserve even the most fastidious taste will find a product at once cheap and of high palatability. Candied papaya is also a product with considerable appeal to children and adults, and which can be manufactured cheaply with no elaborate equipments. The manufacture of crude papain has also been attempted with success.

Jack fruit and custard apple. Manufacture of industrial products from these two fruits which are found almost in wild state in some parts of the Presidency is bound to be of great economic importance. Candied jack, jack syrup and custard apple jam, butter and chutney are some of the products attempted with a good deal of success.

Candied citron peel and kumquats. Of all the fruit products, candying is believed to offer the simplest process for any one to follow. Candied peel of citrons and the whole fruit of kumquat involve very simple methods of preparations consisting of the washing of the fruit, pricking, a gradual impregnation of sugar and final dehydration. Industrially, more complicated processes such as colouring, glazing and improvement of the flavour artificially may have to be employed. But as a cottage industry manufacture of these products from raw fruits which now goes almost entirely to waste merits earnest consideration.

Wild fig powder. Dehydrated sound fruits of *Ficus glomerata* Foxl. which is a tree found to thrive under the most neglected conditions, when ground, give a powder of great relish for eating with milk and sugar added to taste. The raw material costs almost nothing except for collection, but as a final product whether as a base for porridge or for the preparation of a variety of home-made sweets, the fig products deserve to be considered as of no mean dietetic or table value.

The brief account that is presented herewith of the work carried out at Kodur should, it is hoped, convince one of the immense potentialities for the development of our fruit canning and products industry. Up to the end of the last financial year, the total amount spent on manufacture of fruit products amounted to Rs. 2,026—8—10, while the receipts from the sale of

products and the value of stock on hand amounted to Rs. 1,421—14—4. The difference of Rs. 594—10—6 represents the total expenditure purely on research. This small amount expended on work on such a large variety of products over a period of over four years and with such encouraging results can never be said to have been disproportionate to the output or quality of work carried out. Much greater facilities and funds for the conduct and prosecution of research on this field of economic importance is considered most necessary, if the interests of fruit industry in all its bearings is to be properly safe-guarded, and its expansion and development adequately regulated and stimulated.

Preliminary Studies on the Cardamom Thrips (*Taeniothrips Cardamomi* Ramk), and its Control.

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Introducton. The problem of cardamom thrips and their control is one of very recent investigation. Practically nothing was known of them till 1934, when they were first discovered by the junior author to be the sole agent concerned in causing unsightly scabs on the cardamom capsules. Ramakrishna Ayyar (1935) has described the thrips; Ramakrishna Ayyar and Kylasam (1935) have given a short account of the nature and the extent of damage caused by them. Since then the thrips situation has steadily worsened. The cardamom industry for which South India holds a monopoly has been steadily deteriorating as a result thereof. In view of the importance of the cardamom industry which is computed to give a turn over of nearly Rs. 10,000,000 per annum from a total production of 8,000,000 pounds of capsules, it was felt that the problem of thrips control required immediate attention. Experiments were started by the Entomologist in collaboration with Mr. K. M. Thomas, Government Mycologist, in 1939 at the Korangumudi Estate, Valparai (Anamalais Hills), where damage by thrips was reported to be very severe. The object of the experiment was to find out if it was possible to secure significant diminution of scab injury of the capsules by a reduction of thrips population with the aid of toxic sprays and dusts at a time when the thrips population was high.

Host and its Environment. The host plant is a herbaceous perennial and is cultivated under the shade of primary forests at elevations of 2,500 ft to 4,000 ft. Blossoming would appear to be governed by the extent of. rains received in February—March; if for any reason the rains hold off at this critical period flowering is held back and a very poor crop finally results. In favourable seasons the blossoming would start by April and reach the peak by the end of May. The flush would wane thereafter but the plants will continue to produce scattered flowers till the end of December. Molegode (1938) and Subbiah (1940) have given detailed accounts of the

host and its habitat, from which it is possible to visualise the conditions under which the thrips thrive and assume pest proportions year after year.

Nature and Extent of Damage due to thrips. The scabbed patches seen on the affected pods are the result of the injury caused by the thrips feeding on the ovary in the tender stages of the blossoms. Both the adults and the nymphs get access to the deep-seated ovary long before the outer, closely adpressed bract opens out, and cause severe injury to the tender tissue through extensive feeding before the flower normally opens. Minute droplets of sap exudations could be seen oozing out from the ovary at the spots where thrips had lacerated the tissue and sucked the sap. The injured portions of the ovary gradually develop corky encrustations which persist as scabs on the outer skin of the capsules long after the actual damage is done. In cases of severe infestation, the scabs on the capsules are numerous and extensive. Roughly 75% to 80% of the fruits were found scabbed in varying degrees in the samples examined from Korangumudi Estate in 1939. About half the damaged fruits showed very severe scabbing, the scabs extending all over the outer skin of the capsules. The loss caused by way of shedding of flowers and tender fruits due to thrips is estimated by Mr. E. N. House to be about 30%. No further damage to the capsule is caused by the thrips after it has attained the size of about 6 mm. No appreciable damage is done to the shoots. The scabbed capsules are not commercially favoured and fetch a low price.

Seasonal Incidence. As the host plant is a perennial, the pest finds it easy to breed right through the year on the same host. But its incidence varies with the season; it is lowest in the months of November, December and January; a sharp rise is noticeable from February onwards. Thereafter it reaches the peak in May and June after which it appreciably drops. The downward trend noted in its population after July may be due to the heavy monsoon rains which would seem to bring it down. The peak period of the pest unfortunately synchronizes with the heavy flowering noticeable in May, and the fruits that set at this period, therefore, show invariably a high percentage of scabs. All the stages of the insect, i. e., nymphs, prepupae, pupae and adults are passed on the plant itself.

Distribution of the thrips on the plant. Adults and nymphs are found in various protected situations; they are found in the inner-most leaf of the spindle, inside the basal sheaths of the old leaves, on the flowering branches, and inside the perianth and round the ovaries. The massing of nymphs and adults is particularly confined to the gaping sheaths of old leaves. Prepupae and pupae are seen only within the perianth and the leaf sheaths.

Regional Distribution. The thrips are well distributed in all the cardamom growing areas such as Anamalais Hills, Mysore, Travancore and Nelliampathy Hills; in the last mentioned place, however, the capsules are exceptionally free from scabs and the pest does not occur on a scale like what is seen in the Anamalais area.

Control Experiments. Experiments were laid out in randomized blocks in a twenty-five year old estate in Korangumudi; each block consisted of five treatments including the control and there were six replications. Each plot consisted of twenty clumps distributed in four rows. The capsules borne on the ten clumps of the two inner rows of each plot were separately harvested and cured after each picking; the produce of each plot of each picking was examined for scabs later on. There were four pickings for each treatment. The effectiveness of the treatments was judged by the presence or absence of scabs on the capsules. For this purpose four random samples were drawn from the material of each plot and each sample was graded as 'good', 'light' and 'bad' depending on the total freedom or otherwise from scabs. 'Good' indicates total absence of scabs; 'light' indicates slight scabbing and included capsules having only two streaks of 2 mm. and less in width and the 'heavy' the rest. Percentages for the three grades were determined on the basis of the sum totals of the four samples of each treatment.

The treatments consisted of spraying with (1) tobacco decoction extracted from the tobacco stems and soft soap; the decoction tested 0·028% nicotine after dilution with an equal volume of water; (2) potash fish oil soap of the Kerala Soap Institute at dilutions of 1 lb. in 6 gallons of water; (3) Bordeaux mixture (0·5%) with coconut oil for improving the adhesiveness; (4) dusting with Cooper's special spreading sulphur of 300 fineness and (5) the control, in which no treatment was given. The first round of treatment was given to the blossoms in the last week of May 1939, with a view to reduce the heavy population of thrips that was then prevalent in them. The first three treatments were carried out with the aid of an "Eclipse" sprayer and the fourth with the help of a "Pfalzgraf" bellows hand duster. Since two gallons of spraying fluid were required for each clump, about 1,400 gallons of the spraying fluid is required for one round of spraying for an acre. Difficulty was experienced in securing easy penetration of the spray fluid even under high pressure into the region of the ovary owing to the presence of the closely fitting bract surrounding the flower which obstructed the passage of the fluid. A higher mortality of thrips could not be secured in view of this handicap. Thrips lodged in the ovary region were therefore found less affected.

The data collected were analysed statistically, and the results are presented in Table I.

It will seen that the treatment differences are significant at 5% level for 'good' pods in the third picking and for all the pickings put together. Significance is not established in the case of treatment differences for the first two and the fourth pickings. Amongst the treatments tobacco decoction spraying alone has given a mean difference well above the critical difference. The absence of significance in the first two pickings is explained by the fact that the material of the two pickings chiefly consisted of capsules

TABLE I.

Statement showing the percentages of "Good", "Light" and "Bad" capsules for all the pickings.

Nature of treatment.	1st picking. 13—10—1939.			2nd picking. 10—11—1939.			3rd picking. 15—1—1940.			4th picking. 15—2—1940.			Total for all the pickings.		
	Good.	Light.	Bad.	Good.	Light.	Bad.	Good.	Light	Bad.	Good.	Light.	Bad.	Good.	Light.	Bad.
1. Sulphur dusting.	61·4	19·8	18·8	52·4	17·1	30·5	55·6	24 8	19·6	65·1	18·8	16·1	58·5	20·2	21·2
2. Tobacco decoction spraying.	56·9	16·9	26·2	59·4	28·4	11·9	80·1	11·5	8·4	77·9	12·9	9·2	70·6	17·3	12·1
3. Potash fish oil soap spraying.	49·3	24·9	25·8	48·5	33·5	18·0	64·0	21 9	14·1	67·3	19 0	13·7	58·6	24·3	17·1
4. Bordeaux mixture spraying.	47·6	26·4	38·0	44·5	26·0	29·5	62·9	22·3	13·8	59·8	20·8	19·4	56·0	24·2	19·7
5. Control.	45·3	18·2	36·5	43·4	13·5	43·1	64·8	18·0	16·6	60·6	18·6	20·8	55·3	16·9	28·6
Critical difference for significance P=0·05.	...	...	...	...	12·9%	9·9%	3·9%	...	...	...	...	...	3·6%	...	9·5%
Whether the treatment differences are significant or not.	no.	no.	no.	no.	yes.	yes.	no.	no.	no.	no.	no.	no.	yes.	no.	yes.

that had set a couple of months before the spraying was given and as such could not have had the benefit of the treatment.

Conclusions. (1) Reduction of scab injury due to thrips attack is possible through insecticidal treatment.

(2) Tobacco decoction spraying alone has been found to give statistically a higher percentage of good pods totally free from scabs.

(3) Early and later rounds of sprayings are indicated to be necessary if effective control of scab injury in capsules is desired in the first two and later pickings.

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A Short note on dry-land paddy in Udayarpalayam.

By T. V. AYYASWAMI IYER,

Agricultural Demonstrator, Ariyalur.

The Udayarpalayam taluk of the Trichinopoly district is noted for the cultivation of dry (purely rain-fed) paddy. This occupies about 30,000 acres of red sandy soils. The average rainfall of the tract for the preceding five years is 13·9 inches in the South-West Monsoon (June to September) and 23·4 inches in the North-East Monsoon (October to December). The important dry paddy varieties are (1) *Perunel*, (2) *Kaivirai samba*, (3) *Kalian samba*, (4) *Kattaikar* and (5) *Motta kuruvai*, and all these varieties are invariably sown broadcast. Taking advantage of the summer showers, the lands are ploughed 4 or 5 times, cattle manure at the rate of about 12 cart-loads per acre applied and the fields kept ready for sowing on the receipt of the first rain.

Peru nel is a coarse variety of about 8 months' duration and is confined to low lying lands where water stagnates till January. This is, therefore, sown early before the land gets too wet for sowing. *Kaivirai samba*, *kalian samba* and *kattaikar* are also coarse varieties but 6 months in duration.

They are sown between 15th July to 31st August. Of these *kalian samba* is more drought resistant than the other two. *Mottakuruvai* is also a coarse but short duration variety of 3 months. This is sown in August—September in high level lands. Generally two weedings are given before the crop is harvested.

The rainfall during the North-East Monsoon period was above average in 1937, 1939 and 1940 and in these years the yield of dry paddy crop was fair. It is, therefore, felt that in places where the rainfall is about 14 inches during the South-West Monsoon period and above 24 inches during the North-East Monsoon period, dry paddy can be tried. As the varieties mentioned above are not fastidious about soil and are doing well in sandy soils where groundnut is grown, it is suggested that these can either replace groundnut or be rotated with it.

EXTRACTS

Importance of the Fruit Products Industry in India. *By Kr. Birendra Narain Singh, M. Sc.* Fresh fruits preserved temporarily are imported into India at an average of thirty lacs of rupees per year, as follows:—1931-Rs 33,66,661, 1932-Rs, 26,63,242. 1933-Rs. 3217,543; 1934 Rs. 28,25,884. Canned and bottled fruits and vegetables worth eleven to twelve lacs of rupees per year are imported:—1931-Rs. 8,35,610; 1932-Rs. 6,96.339; 1933-Rs. 9,50,102; 1934-Rs. 10,66,985; 1935-Rs. 11,02,793; 1936-Rs. 11,23,025; 1937-Rs. 10,06,393 and 1938-Rs. 12,11,598. Fruit products in the form of jams and jellies are imported as follows:—1931-Rs. 4,34,808; 1932-Rs. 3,86,025 1933-Rs. 6,40,577; 1934-Rs. 6,28,948; 1935-Rs. 6.89,192; 1936-Rs. 6,74,289; 1937-Rs. 7,31,887 and 1938-Rs. 6,54,847. Besides the above, preserved fruits in the form of pickles, chutneys, sauces and other condiments are annually imported as follows:—1931-Rs. 4,24,941; 1932-Rs. 3,87,829; 1933-Rs. 6,27,910; 1934-Rs. 7,05 295; 1935-Rs. 6,78,835; 1936-Rs. 6,48,872; 1937-Rs. 7,19,882 and 1938-Rs. 6,21,675.

Besides, it has come to the notice of the present author that a few commercial concerns, constituted to manufacture fruit products on a large scale, failed, not for want of capital, machinery or organization, but for want of accurate and scientific information about the behaviour of different Indian fruits when preserved. Therefore, a systematic study was needed and consequently the author thought it advisable to undertake this kind of investigation particularly with a view to the most satisfactory utilization of the tremendous fruit resources in this country.

As a matter of fact all the Indian fruits can be converted successfully into some form of preserve. But none of this product is being made on a large scale in our country and as a result there is a tremendous waste of fruits and vegetables. Fruit products in the form of canned and bottled fruit jams, jellies, pickles and sauces are imported in our country at an average of about sixty lacs of rupees per year. Such a huge problem which faces us at the present time has attracted but little attention from Government or the public.

Let us examine the fruit gardens of some other lands, where every blade of grass is taken into account and people have made their fortunes out of fruit cultivation; e. g. the Hawaiian Islands, California and the Malay Peninsula. The fruit industry there is very prosperous; they export huge quantities of fresh and preserved fruits, to all parts of the world every year. In the course of the

last few years, almost all the sixteen concerns in Malaya have rebuilt their factories according to modern designs fitted up with up-to-date machinery. The average capacity of a factory is between 1,500 and 2,000 cases or about a lack of tins per day. Every factory is equipped with a semi-automatic can-making plant and makes its own cans. Peeling, coring and slicing is done by hand, employing about 200 to 300 labourers in each of the factories. In all, nearly five thousand men are engaged in Malaya in the canning industry.

Malaya is the second largest producer of canned pineapple, Hawaii taking the premier position. The export value of the pineapples in the Hawaiian Islands amounts to about twenty crores of rupees as compared to the export value of the Malayan Peninsula, which is about a crore and a half of rupees. Surplus fruits are bottled and canned in huge factories, the capacity of the smallest of them being a lac of tins per hour. Every portion of the fruit is employed to advantage, not a single fruit can be found rotting anywhere. Every plantation, every plant and every fruit is properly kept and protected against damage from insect pests, wind and frosts. Several lacs of pineapples are canned in a day.

The growing and the canning of pine apples has increased to such an extent in the Hawaiian Islands that in a few years the annual tonnage has grown from few hundred tons to the tremendous total of over two lacs of tons of this delicious fruit. The factories are fitted with automatic peeling and coring 'Ginaca' machines, dealing with forty to sixty pineapples per minute. Each canning unit consists of one 'Ginaca' machine, trimming table, a slicing and a packing table. The two largest canneries have nineteen and twenty such units. On each side of the table fourteen to eighteen women are employed, for hand trimming one of the most carefully supervised operations. 'The Pittaluga' syruper is in general use, filling sixty to a hundred cans per minute. Nearly 1,500 workers are employed in each of the larger plants. The rate at which the tin cans are manufactured in Honolulu, is about ten lacs per day. In summer hundreds of school boys and girls work in the these huge factories to earn school fees. Trades are usually under Government control and only the best fruit can be marketed. Besides giving subsidies to the fruit preserving factories the Government imparts education and training in fruit culture and preservation to the growers, so much so that the subject of fruit preservation has been included in the curriculum of the school and University.

Compare this with the state of affairs in our country. During harvest time we can witness heaps of fruits, fancy or contaminated, all heaped together on the road side or in front of a shabby orchard, being rendered unmarketable.

All these crude methods of handling and preserving fruits are responsible for the heavy import of both fresh and preserved fruits into our country. Besides, there is also much scope for Indian specialities like canned mangoes, and mango preserves, jams and pickle in the foreign market, in view of the fact that they were much appreciated at the British Empire Exhibition. Guava jelly has already gained a good reputation in India.

Fruit preserving factories on modern lines can be started with a capital of fifty to sixty thousand rupees which would be capable of canning and bottling goods worth nearly two lacs of rupees per year, yielding a net profit of twenty per cent. on the goods sold. The establishment of half a dozen such factories all over India would stop the wastage of huge quantities of surplus fruits and the drainage of enormous wealth to foreign countries. Besides, it would open a new industry for Indian capital utilizing sugar, tin cans, glass bottle and other utensils produced by Indian factories. It would increase the growth of fruits by improved methods, and solve the problem of marketing fruits and vegetables, giving relief to cultivators.

The fruit industry can also be started on a semi-commercial scale, with a nominal capital of five thousands of rupees only, producing goods worth over one hundred rupees per day which can easily be consumed in a few adjoining districts. Such works are running at certain places in India, with the result that some amount of preserved fruits in the form of pickles and chutneys are exported from India, as the following figures indicate, which are decreasing amounts:—1931-Rs. 82,166, 1932-Rs. 8,26,794, 1933-Rs. 8,57,022, 1934-Rs. 6,55,555, 1935-Rs. 4,91,008. But fresh and preserved fruits and vegetables in various forms are annually imported to our country amounting to over fifty-five lacs of rupees, as follows:—Fresh fruit and vegetables Rs. 30,86,589, Canned and bottled fruits Rs. 10,58,065, jams, jellies, pickles, sauces Rs. 13,64,195, average total Rs. 55,08,849.

Thus the necessity of establishing this industry on a much larger scale can be fully realised. Of course, the success of such enterprises will to a great extent depend on the support of the government. It is a matter of satisfaction that the central and local governments have accepted some of the suggestions of the Royal Commission on Agriculture in India, by appointing the central maketing board and creating cold storage facilities. The Imperial Council of Agricultural Research is taking keen interest in the fruit industry.—*The Planters Gazette*, Vol. 2, page 13, August 1941.

Carbonated Citrus fruit Beverages. *By Roshan Lal Tandon*. Carbonation which consists of impregnating a beverage with carbon dioxide gas, besides giving a sparkling appearance, imparts a sharp, piquant taste which is very much relished. Carbonated fruit beverages promote the growth of yeast, spoiling the product by fermentation. For this reason it is necessary to pasteurize the finished product or preserve it by means of sodium benzoate. The bottler dislikes to go to the expense of installing pasteurizing equipment in view of the large expenditure involved in it and the consumer is suspicious of benzoated products. Therefore, the ordinary trade practice is to store the citrus juices when the fruits are in season and preserve it by potassium metabisulphite for use during summer for the preparation of carbonated fruit beverages. Instead of carbonating a large quantity of bottles at a time it is always preferred to prepare just a sufficient quantity that may be consumed in about a week's time.

In foreign countries fruit juice concentrates are used for the preparation of carbonated beverages, the object being to use small doses of these which when diluted with carbonated water will approximately contain the same food value as the original real fruit juice from which the concentrate is obtained. But in India the manufacturers of carbonated fruit beverages do not want to undergo an extra expense of concentrating the fruit juices. They would, therefore, always prefer to use the fruit juices as such.

Preparation of the Syrup. For the purpose of preparing a syrup the required amount of water is boiled in an aluminium kettle and saccharine added to it which readily dissolves in hot water. Sugar is then added, the solution is well stirred and boiled again to give it a syrupy consistency. Since the syrup and juice get diluted during carbonation, the addition of citric acid is desired to build up the acidity and this is added at the last stage when saccharine and sugar have both gone into solution. All the dirty matter of the sugar comes to the surface and can be filtered off through a piece of muslin cloth. In preparing a syrup, hot filtration is always preferred to facilitate the process. The use of saccharine may be economical to the dealers from trade point of view but the author is of the opinion that the use of pure cane sugar alone should be encouraged as far as possible.

For Carbonated Lemon Juice—sugar 84 lb. and water 40 lb.

For Carbonated Orange Juice. Since the acidity in pure orange juice is very low, the addition of citric acid is desirable,—sugar 84 lb. water 40 lb. and citric-acid 8 oz.

Carbonating and Bottling the Beverage. The finished beverage, for low price trade should not contain less than 10 per cent. by volume of actual juice and for better class trade not less than 25 per cent. of actual fruit juice. A typical formula for 12 oz. soda water bottle is, fruit juice 1–2 oz., syrup 2 oz., flavouring essence mixture 6 drops ($\frac{1}{10}$ fluid drachm) and colour sufficient. This is to be carbonated at 100 lb. pressure. Before serving the drink it is customary to add a pinch of powdered common salt and black pepper to bring forth the latent taste. The carbonated fruit beverage prepared as above does not require any dilution and is taken as such served with ice or plain.

Preservation. Carbonated fruit beverages can be preserved successfully by use of only 0·05 per cent. of sodium benzoate. This may be added to the syrup in such amounts that the finished beverage contains 0·05 per cent. of benzoate. It has been found by experience that the carbonated fruit beverages remain in excellent condition for about a fortnight even without the addition of any preservative and thereafter a flat taste begins to develop. Since the ordinary trade practice is to prepare fresh stock every day, the question of preservation does not offer a serious problem to the manufacturers. A 12 oz. carbonated lemon or orange beverage prepared as above costs only 2 pice and is sold at 0—1—6 each, thus leaving a net profit of 200 per cent.—*The Punjab Fruit Journal*, Vol. 5, P. 990, July 1941.

ABSTRACTS

The effects of fertilizing both the seed bed and the field upon the yield of Elon-elon rice. Celso C. Songcuya. *The Philippine Agriculturist.* 30 (1941):107—119.—One of the best commercial fertilizers tried with Elon-elon rice has been Corona Arroz. The yield of rice and the profit and loss of (1) fertilizing the seed bed alone with different amounts of the fertilizer (2) fertilizing the field alone with 150 kgm. per hectare and (3) fertilizing the seed bed with different amounts of the fertilizer and the field with 150 kgm. per hectare of the same fertilizer was a piece of interesting study undertaken in the latter half of 1940 by the author in the low land rice fields. The following conclusions had been arrived at:—

The different amounts of Corona Arroz used as fertilizer at the rate 50, 100, 150 and 200 kgm. per hectare in seed bed alone, in both seed bed and the field or in the field alone did not materially influence the flowering and maturity periods and the number of bearing culms (tillers) per hill of Elon-elon rice remained uniform. The plants of different treatment and control began to flower 139 days after the seeds were sown and matured 37 days after flowering. As far as yield was concerned, fertilizing the field in any way was advantageous whether the seed bed had already been fertilized or not. Of course, fertilized seedlings gave a higher yield than the unfertilized. Maximum yield was obtained by fertilizing both the seed bed and the field at the rate of 100 kgm. and 150 kgm per hectare respectively. The application of 150 kgm. of Corona Arroz fertilizer in the field gave an increase of 23·5 per cent. yield over that of the control.

With regard to profits resulting from the different treatments the author had considered the cost of fertilizer and the cost of application and the current price of Elon-elon rice at the time of harvest. The plants fertilized with 100 kgm. per hectare in the seed bed alone gave a profit greater than those obtained for plants fertilized with 200 kgm. per hectare and also 150 kgm. per hectare in the field. The highest profit of 32·7 Pesos per cent was recorded in the treatment where the seedlings were fertilized in the seed bed at the rate of 100 kgm. per hectare

followed by 150 kgm. per hectare in the field. 100 kgm. of the fertilizer per hectare in the seed bed alone gave 18·56 Pesos per hectare while 50 kgm. per hectare in the seed bed gave a profit of 13·38 Pesos per hectare. K. I. C.

India's cashewnut trade in America. *Indian Information*, Vol. 9, No. 78, August 15 1941, pp. 168—169. The cashewnut which was unknown in America a generation ago is now a familiar article of food stuff due to the rapid development of the market for this product brought about by its cheapness and delectable taste and the popularisation campaign carried on by one of the largest foodstuff concerns in the country. The United States import almost all their supplies from India, only a nominal quantity being taken from elsewhere. The imports in 1939 reached a figure of over 29 million pounds of the nut and it is reported that there is further scope for expansion of trade in this commodity. There are, however, certain factors which must be considered if fullest expansion of trade in Indian cashewnuts is to be brought about.

The question of price and price fluctuation is of peculiar importance in the cashewnut trade. The importers and merchants guarantee their sale price against decline and as they usually make contracts on the basis of prices on forward purchase, a subsequent decline in price result in loss. This loss is aggravated in the case of the large scale importer who cannot afford to gamble on prices and it is therefore considered that the trade in cashewnuts is more profitable and satisfactory to the comparatively small importers than to the largest. It is also suggested that the situation is made worse by the existence of speculation in Bombay both in the African and Indian cashewnut crops. Such speculation, if it is proved to exist, will not only bring about an unsettling factor in Indo-American trade but also hinder the Indian producer from obtaining a legitimate price for his product. The possibility of making pre-season crop surveys and the establishment of price control by the Government as means of rectifying the difficulties in the cashewnut trade might be considered.

The other important factor is quality. Lack of grading and shipment at times, of goods too poor in quality for the American market for which the importers have to make allowances, coupled with the narrow margin of profit on which the importer works, is a real hindrance to the furtherance of Indian export trade in cashewnuts. This might be overcome by the adoption of a system of Government grading.

Cashewnut trade is in a sound position today because of the general acceptance of this product as part of the American diet but the factors detailed above are serious impediments to trade. There will also be competition from other nuts such as Brazil nuts and pecans and the indigenous peanuts, if cashewnuts do not maintain their price advantage and quality. Although the cashewnut trade in the United States has continued to increase, such unsatisfactory features as now exist need to be rectified as far as possible to guarantee the preservation and further development of the American market, which is by far India's largest market for her cashewnut exports (U. N. R.) C. M. J.

Gleanings.

Seed treatment and crop outturn. There is now no doubt the beneficial effects of seed treatment for the control of certain seed-borne diseases; but the question is if the seed treatment has any stimulating effect on the yield if healthy seeds are treated. In other words, from the farmer's point of view the question is: Is it a paying proposition to treat seeds even if they are known to be free from disease, or should the seed be treated only when it cannot be guaranteed to be free from disease? The experience gained during the last four years in the

Central Provinces shows that at least in the case of cotton and *jowar* seed treatment increases the yield even when the seed is free from disease.

Need for treatment. Cotton anthracnose in certain years causes considerable damage to bolls. Seeds from infected bolls are also usually diseased but may not be so badly infected as to be incapable of germination. Therefore the danger is that seeds, even though diseased, may be used the following season as externally they do not look much different from healthy seeds. From such infected seeds the seedlings will be diseased and will damp off and the infection may spread to the neighbouring healthy seedlings. The result is a heavy loss of seedlings, and often resowing has to be done, and still the result will once again be the same. If the seeds are treated before sowing not only is the disease checked when diseased seed is used but the yield is increased even when healthy seeds are sown.

For seed treatment, copper carbonate, finely powdered sulphur, commercial sulphuric acid and four proprietary fungicides have been used. The following table shows the percentage of increase in yield per acre when healthy seeds are treated:

—	1936-37	1937-38	1938-39	1939-40
Seed treated with proprietary fungicide A	14·4	27·0	38·3	19·0
do. B	9·1	20·6	44·6	21·1
do. C	8·0	13·9	40·3	17·5
do. D	16·3	25·9	25·9	...
Seed treated with copper carbonate ...	25·3	24·9	38·9	8·2
Seed treated with sulphur	15·2	29·2	33·7	19·5
Seed delinted with sulphuric acid ...	8·7	9·9	10·4	...
Control	0	0	0	0

The last four results show that the increase in yield from treated cotton seed is substantial though the percentage of increase varies from season to season. The proprietary fungicides, copper carbonate and sulphur, are each added to the cowdung solution locally used for dressing the seed to enable it to pass through drills. One ounce of each of these fungicides and chemicals is used for treating 28 lb. of seed.

Treatment of healthy seed. Jowar seed is usually treated for the control of grain smut and loose smut diseases. *Jowar* seed free from smut infection when dusted either with copper carbonate or finely powdered sulphur or two proprietary fungicides has given better yield than untreated healthy seed. The following table shows the percentage of increase in yield per acre when healthy seeds are treated:

—	1936-37		1937-38	
	Grain.	Fodder.	Grain.	Fodder.
Seed dusted with proprietary fungicide A	19·4	9·9	8·1	5·1
do. D	12·6	9·7	11·3	7·5
Seed dusted with copper carbonate ...	5·3	6·3	3·2	3·2
Seed dusted with sulphur	11·5	8·3	7·3	4·6
Control	0	0	0	0

The proprietary fungicides were used at the rate of 1 oz. for 20 lb. of seed and copper carbonate and sulphur at the rate of 1 oz. for 48 lb. of *jowar* seed.

These results show the necessity for further trials with other crops. (*Ind. Farm*, 2:425, August 1941.)

***Amla*—a rich source of vitamin C.** *Amla* is very rich in vitamin C, the vitamin which prevents scurvy. It contains only traces of other vitamins. It is the best natural source of vitamin C so far discovered, containing from 5 to 7 mgm. of the vitamin per gramme of fresh pulp. A medium-sized *amla* fruit yields as much vitamin C as two oranges. The fresh juice contains ten times more vitamin C than orange juice, lime juice, or tomato juice. When *amla* fruits are pickled in concentrated salt solution they retain a good deal of their vitamin C even after storage for several months.

Nearly all fruits and vegetables lose their power to prevent scurvy when dried. Of all the vitamins, vitamin C is the most easily destroyed by drying or heating. *Amla* can, however, be dried and yet remain a rich source of this vitamin. There are two reasons for this. First it contains certain tannins which have a protective effect on the vitamin, and secondly, its juice is very strongly acid. As acid medium tends to prevent destruction of vitamin C. these factors do not completely prevent loss of vitamin C when *amla* pulp is dried, but they minimise it. It is, however, essential that the pulp should be dried quickly; otherwise there is considerable destruction. *Amla* powder dried under proper conditions is so rich in vitamin C that one gramme can furnish an adult with his daily requirements of the vitamin. The amount of the vitamin present in the powder is slowly reduced if the powder is exposed to air, particularly in a hot atmosphere, but even after storage for several months it remains a very rich source of vitamin C. (*Ind. Farm.* 2: 374 and 427; 1941.)

[*Emblica officinalis* Gaertn. (*Phyllanthus emblica* Linn.); Tamil—*Nellikai*: Telugu—*Usiriki*. Editor.]

Edible syrups from Molasses. Little success has attended the many attempts made for the utilization of exhaust molasses in the manufacture of confectionery and other articles of human diet, chiefly due to difficulty in the removal of undesirable substances like bitter inorganic salts, large quantities of caramel and other organic impurities present in molasses. Although cane molasses is being used for the manufacture of cattle-feeds, it has not been possible to make it sufficiently pure and palatable for human consumption.

While the consumption of table syrup is very large in other countries, especially in the U. S A., in India it is limited at present, the chief reason being probably the high price of the imported product. If a cheap and palatable syrup could be placed on the market, its use would become more extensive. Work done at the Imperial Institute of Sugar Technology by Dr. K. A. N. Rao has shown that such a product can be prepared by precipitating all the sugars in molasses as lime compounds from which they are subsequently recovered by carbonisation. By this method, it has been possible to recover 80 per cent. of the sugars originally present in the molasses. The sugar solution filtered from calcium carbonate is treated with phosphoric acid and lime, or activated vegetable carbons, and concentrated to a syrup of 75° Brix. The syrup obtained has a good taste and is pleasing to the eye. No crystals are deposited even after standing for more than a year

The results obtained indicate that table-syrups can be profitably manufactured from molasses. The price of the syrup manufactured will depend on the quality required. By concentrating sufficiently, a part of the sucrose can be recovered and the residual syrup will still be suitable for table use. The cost of the syrup after recovery of sucrose will be only a fraction of the price at which it is sold in the market and hence its use could be made popular. It could also be used for other purposes such as preparation of jams and sweetmeats—in fact for any purpose for which a sugar solution is required. Supplies of syrup could be made to the army in barrels and will be a cheap and valuable article of diet.

This syrup can be used for most of the table purposes in place of sugar itself. It is as wholesome and as nutritious as cane sugar itself, perhaps even more so, and an important advantage of this syrup over cane sugar is that its sale is not liable to levy of excise duty. *Ind. Farm.* 2 : 426, August 1941.

Trees on the Farm. Trees serve many important purposes on farming and pastoral country. Trees are valuable as—

1. Windbreaks and shelter belts.
2. For isolated or scattered shade and shelter.
3. A reserve supply of fodder for periods of drought.
4. Timber and fuel supplies.
5. Screens around dams and tanks to prevent silting up by dust, and undue evaporation of the water.
6. For the prevention of erosion on slopes and along the banks of creeks and rivers.
7. For ornamental plantations in improving the appearance of the home.

(*Queensland Agri. Jour.* 55: 489, June 1941)

Advertising by Wisconsin Department of Agriculture. Milk and Honey is being featured in outdoor advertising as a co-operative project between the Wisconsin Beekeepers' Association and the Wisconsin Department of Agriculture.

Three hundred and fifty posters, 7×9 feet in size, were prepared in color by the Department of Agriculture. One hundred and fifty-six of these were put up on boards controlled by the Department of Agriculture throughout the State, while 40 were sent to beekeepers who wished to co-operate by putting them on their honey houses, barns etc. The signs will be left for a period of six weeks— during the last half of March and all of April. The rest of the signs will be kept and used again next fall for another campaign. (*Gleanings in Bee Culture,* May 1941, page 311.)

Crop & Trade Reports.

Statistics—Crop—Sugarcane—1941—Intermediate condition report. The condition of the sugarcane crop is satisfactory in all the districts outside Kistna, Cuddapah, Chingleput, Chittoor and North Arcot, the uplands of East Godavari and parts of West Godavari, where the crop suffered from drought to some extent. A normal yield can be expected in the other districts if the season continues to be favourable.

The wholesale price of jaggery per Imperial maund of $82\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 8th September 1941 was Rs. 6—1—0 in Mangalore, Rs. 4—15—0 in Adoni, Rs. 4—7—0 in Vellore, Rs. 4—6—0 in Cuddalore, Rs. 4—2—0 in Vizagapatam, Cocanada, Rajahmundry, Chittoor and Trichinopoly, Rs 3—11—0 in Vizianagaram, Rs. 3—7—0 in Coimbatore, Rs. 3-5-0 in Salem and Rs. 3—4—0 in Bellary. When compared with the prices published in the last report, i. e., those which prevailed on 4th August 1941, these prices reveal a rise of approximately 12 per cent. in Vizagapatam, 7 per cent. in Vizianagaram, 4 per cent. in Coimbatore and 3 per cent. in Cuddalore and a fall of approximately 12 per cent. in Trichinopoly and 8 per cent. in Mangalore, the prices remaining stationary in Cocanada, Rajahmundry, Adoni, Bellary, Chittoor, Vellore and Salem.

Statistics—Cotton—1941-42—Intermediate forecast report. *Last year's crop.* The yield of the second or summer pickings of the 1940-41 crop is estimated to be generally fair.

Current year's crop. The main season for sowing is not yet over in most parts of the Province. Sowings of the crop are in progress in parts of Circars and the

Deccan. The early sown crop in parts of the districts of West Godavari, Kistna Guntur and the Deccan is reported to have been affected by drought to some extent.

The average wholesale price of cotton lint per Imperial maund of $82\frac{2}{7}$ lb. equivalent to 3,200 tolas as reported from important markets on 8th September 1941 was Rs. 17—5—0 for Cocanadas, Rs. 18—2—0 for red Northerns, Rs. 20—9—0 for white Northerns, Rs. 16—8—0 for Westerns (Mungari crop), Rs. 22—0—0 for Westerns (Jowari crop), Rs. 40—10—0 for Coimbatore Cambodia, Rs. 29—10—0 for Southern Cambodia, Rs. 36—10—0 for Coimbatore Karunganni, Rs. 27—15—0 for Tinnevellies and Rs. 28—10—0 for Nadam Cotton. When compared with the prices published in the last report, these prices reveal a fall of 5 per cent. in the case of Southern Cambodia and Nadam Cotton, 4 per cent. in the case of Coimbatore Cambodia and Tinnevellies and a rise of 5 per cent. in the case of Cocanadas, the prices remaining practically stationary in the case of Northerns (red and white), Westerns (Mungari and Jowari), and Coimbatore Karunganni.

Statistics—Ginger—1941—First forecast Report. The area under ginger up to 25th August 1941 is estimated at 10,900 acres in Malabar and at 600 acres in South Kanara as against 12,000 acres in Malabar and 800 acres in South Kanara estimated for the corresponding period of the previous year. The condition of the crop is satisfactory and a normal yield is expected.

Statistics—1941—Pepper—First forecast Report. The area under pepper up to 25th August 1941 in the districts of Malabar and South Kanara is estimated at 105,900 acres, (97,000 acres in Malabar and 8,900 acres in South Kanara) as against 102,500 acres, (94,000 acres in Malabar and 8,500 acres in South Kanara) estimated for the corresponding period of the previous year. The yield is expected to be normal.

The wholesale prices of pepper per Imperial maund of $82\frac{2}{7}$ lb. equivalent to 3,200 tolas as reported from important markets on 8th September 1941 was Rs. 11—13—0 at Calicut, Rs. 11—5—0 at Tellicherry, and Rs. 12—2—0 at Mangalore. When compared with the prices which prevailed on 6th January 1941, these prices reveal a rice of about 20 per cent at Mangalore, 24 per cent at Tellicherry and 33 per cent at Calicut. *(Director of Industries and Commerce).*

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 12th September 1941 amounted to 547,447 bales of 400 lb. lint as against an estimate of 503,500 bales of the total crop of 1940-41. The receipts in the corresponding period of the previous year were 425,020 bales. 480,963 bales mainly of pressed cotton were received at spinning mills and 59,324 bales were exported by sea while 94,299. bales were imported by sea mainly from Karachi and Bombay.

(Director of Agriculture.)

Mofussil News and Notes.

Nilgiris District—Agricultural Shows in Model Villages of Ootacamund and Coonoor Taluks. The villages of Anikorai and Tuneri in Ootacamund taluk and Edapalli and Illithorai in Coonoor taluk were selected in the year 1937 as model villages for intensive rural reconstruction work and it was decided at the District Periodical Conference to award a shield in rotation to the best village where rural reconstruction work is carried on with enthusiasm with reference to agriculture, sanitation and livestock, beginning from this year. For this purpose, agricultural shows were held in the above villages during the 2nd and 3rd week of August 1941. The villagers had exhibited all kinds of produce grown in

the village such as potato, cereals, vegetables, fruits, etc. Products out of side-lines such as honey, eucalyptus oil, eggs and milk products were also exhibited. The Agricultural Department had put up improved ploughs, samples of seeds of cereals, vegetables, green manure, insecticides, beehives and appliances, cattle shed models, posters on agricultural subjects, etc. Officers of the Agricultural, Veterinary, Public Health and Revenue Departments co-operated in the successful conduct of the shows. The agricultural aspect of the villages was judged by the Curator and District Agricultural Officer, Ootacamund, assisted by the Agricultural Demonstrators, Ootacamund and Coonoor, the sanitation by the officers of the Public Health Department and the livestock by the officers of the Veterinary Department, and marks were alloted. In judging the agricultural standard of the villages, soil erosion, control measures, manure preservation work, introduction of pasture grasses, sidelines to agriculture and, above all, general interest evinced by the villagers were taken into consideration besides the kinds of crops grown and the methods of cultivation adopted.

The exhibitions held at Edapalli and Illithorai deserve special mention. At Edapalli, the exhibitions were of a higher standard and the village sanitation better than others. The village is very advanced in the cultivation of vegetables and fruits, in cattle manure preservation and in apiculture. The storage and care of Farm Yard Manure is equally satisfactory at Illithorai. But the most noteworthy feature of the latter village is the interest evinced by the villagers in cleaning the village, arranging the show, exhibiting their produce and in competing for the trophy. Sri H. B. Ari Gowder, M. L. A., President, District Board, Nilgiris, and Mrs. Cousins of the All India Women's Uplift Association were among the prominent visitors to the Illithorai show and they addressed the large gathering of villagers on rural reconstruction work. The Curator and District Agricultural Officer, Ootacamund and the Agricultural Demonstrator, Coonoor, addressed the gathering on improvements in Agriculture. The School girls entertained the audience by songs and dialogues on agricultural subjects.

At the District Periodical Conference held on 19th August 1941 the villages were ranked in order of merit as Edapalli, Illithorai, Tuneri and Anikkorai and it was decided to award the shield to *Edapalli* village this year. P. A. N.

All India Industrial Swadeshi Exhibition, Salem. The Salem Municipality conducted the third All India Swadeshi Industrial Exhibition at the Victoria Market Maidan from 3–8–41 to 18–8–41, during the local Mariamman festival. Various industrial products like ivory works, metal works, perfumeries, silverware, medicines, biscuits, coir mats, furniture, foot wear, electrical lamps and soaps, besides hand woven silk and cotton cloths were exhibited by various manufacturers. The nurserymen exhibited their seeds and seedlings and the forest products were displayed by the Forest Department. The Agricultural Department exhibited improved strains of paddy, millets, oil seeds and cotton and specimens of clarified oils, malts and malt biscuits, with numerous attractive posters detailing the various departmental activities. Improved ploughs, cultivators, chaff cutters, horticultural tools, specimens of various crop pests and diseases with insecticides and fungicides and a live colony of bees with bee-keeping appliances were on the show. Besides these, live specimens of green manure crops were arranged. Specimens of agricultural products obtained from the farmers of the district made the show more attractive. Seeds of paddy, coconuts, sugarcane and jaggery produced by cultivators were shown. Specimens of fruits grown on the Kolli Hills, coconut seedlings, fruit plants and fruit products were put on the show. The Exhibition was opened by T. G. Rutherford Esq., I. C. S., Advisor to His Excellency the Governor of Madras on 3–8–41. Large crowds numbering thousands went round the show every day. Music perfor-

mance was arranged by the Municipality every evening and War Fund Raffle tickets were also on sale. Ploughing demonstrations were done on two days and large crowds witnessed the operations. On the closing day the Collector of Salem R. M. Sundaram Esq., I. C. S., distributed prizes and a Certificate of Gold Medal was awarded to the Agricultural Department for the show of agricultural products. The net proceeds of the exhibition amounting to over Rs. 4,000 were given over to the War Fund. R. C.

The Kodur Orange Grading Station was opened on the 5th of this month by S. Ranganathan Esq. O. B. E., I. C. S., Collector of Cuddapah in the presence of a large gathering, The Collector in opening this station congratulated the Kodur Fruit Growers' Co-operative Society in adopting this method of standardising the oranges and expressed his opinion that this splendid idea would inspire confidence in the public. He stressed the importance of all the orchard owners of the *taluk* getting into the folds of the society. Unless the whole produce passed through the society the real object of supplying graded and standardised oranges throughout the Province would be difficult. After light refreshments the function came to a close. T. K. V.

College & Estate News.

Students' Corner. A parliamentary debate was held under the auspices of the Students' Club on 20—8—'41 with Sri Adivi Reddy (B. Sc., III year class) as the Speaker, Sri. K. M. Thomas, Government Mycologist acting as the observer. The subject was "That in the opinion of the house the expansion of the Viceroy's Executive Council is a real constitutional advancement". The proposition was voted down by the whole house except the 'Government' benches. The observer remarked that the standard of debate was very good. Another debate was held under the auspices of the Students' parliament on 27—8—'41 with Sri. C. Shankara Rao, (B. Sc., III year class) as the Speaker. Sri. R. M. Savoor, Divisional Inspector of Schools, Coimbatore, acted as the observer. The House debated on "That in the opinion of the house English education has done more harm than good to Indians" and voted down the proposition. The observer narrated his experiences in the field of education in a very interesting way.

Games. *Tennis.* There was a friendly Tennis match between the Agricultural College Students and Engineering College Students (Electrical) on 6—9—'41. The Agricultural College representatives Messrs. P. S. Chintamani and A. Subba Raju won the match by 6 games to 5.

Badminton. There was also a badminton match between the Agricultural College students and the Engineering College students on the same day. The Agricultural College won the match by 2 games to 1.

Football. There were two matches, one on the 4th of August and the other on the 21st of August between the Agricultural College students and the R. R. Club on the first occasion and with the local Arts College on the second occasion; the first match ended in a draw and in the second the College lost the game by 3 to 1.

Refresher Course. The officers of the Department deputed for the Refresher Course have reported, and the course has commenced on the 15th of the month. A list of the officers deputed for the course is printed elsewhere in this number.

Association of the Economic Biologists. Under the auspices of the above association Dr. Panse of the Institute of Plant Industry, Indore, delivered a series of lectures on the technique of layout of agricultural experiments and statistics in relation to plant genetics. The lectures which were very instructive were

attended by the entire staff and students, and were greatly appreciated. The lectures were delivered on 27th, 28th and 29th and the lecturer was entertained at a Tea on the 30th of August, by the members of the Association.

Scouting. A public meeting of the residents of the Agricultural College Estate was held on 29th August 1941 with Mr. R. C. Broadfoot, Principal presiding. The question of reviving scouting activity on the College Estate was discussed and it was resolved that a committee consisting of 12 members be constituted to manage the affairs of the Ramakrishna Scout Group. The Principal, Agricultural College, was nominated as the ex-officio President, and Mr. C. M. John as the Vice-President. The following committee members were also nominated: Messrs. P. D. Karunakar, C. Rajasekhara Mudaliar, C. S. Krishnaswami, C. V. Nagaraja Rao, D. Devasirvatham, D. Natarajan, T. S. Lakshmanan, K. K. Nambiar and T. Sadagopa Ayyangar. Mr. R. Ratnam was nominated as the Honorary Secretary. The question of repairs to the existing building of the Boy Scout Association was discussed, and it was resolved that to finance the repairs for the building and also to provide necessary equipment for the Scout Troop, donations from parents be solicited. The Scout Troop now consists of 38 boys in all, of the ages of from 11 to 18, and it commenced work on 31st August 1941.

Agricultural College Officers' Club. The Annual Club Day celebrations were held on Saturday, the 20th September, 1941 The annual dinner was on the 19th night. The events on Saturday commenced with the usual *Chota Hazari* given by the President of the Club. The final matches in tennis and tenekoit, which had to be postponed an account of inclement weather, were then played out. Punctually at 8 A.M. the field sports started, every item of which was keenly contested with the result, that it was 12 o' clock before they could be finished. The afternoon session started at 2-30 P. M. with the blow ball competition. The elders' and children's races followed, after light tea.

The President then distributed the prizes to the winners in the various events. The Club Day entertainment was held at 9 P. M.

The following is the list of prize winners in the major events:—

Items.	*Winners.*	*Runner-up.*
1. Tennis (singles) (C. Ramaswami's cup)	C. N. Babu.	K. Ramaswami.
2. Tennis (doubles) (Rao Bahadur G N. Rangaswami Ayyangar's cup)	C. N. Babu and C. T. Ittyachan.	K. M. Thomas and K. M. Krishna Menon.
3. Contract Bridge (open) (Padmanabha shield)	G. K. Chidambara Iyer and R. K. Iyengar.	V. S. Sankaran and P. S. Narayanaswami.
4. Contract Bridge (Partners by lots) K. Ramiah's Cup and Mr. Dutt's Cup)	V. S. Sankaran and K. Santhanam.	M. S. Kylasam and V. Gomathinayagam.
5, Table Tennis (singles) (M. C. Cherian's Cup)	N. M. Naidu.	C. H. Krishnan.
6. Table Tennis (doubles)	C. H. Krishnan and T. S. Francis.	C. N. Babu and M. M. Krishna Marar.
7. Tenekoit (Dr. K. Narayanan's Cup)	N. M. Naidu and K. M. Kulandai.	A. K. Nambiar and P. A. Venkateswara Iyer.
8. Carrom (singles) (K. Krishnamurthi Rao's Cup)	C. H. Krishnan.	E. G. Sivaswami.
9. Carrom (Doubles) (H. Shiva Rao's Cup)	C. S. Rajaratna Mudaliar and K. Santhanam.	P. K. Menon and T. N. Ananthanarayanan.

10.	Chess (M U. Vellodi's Cup)	E. J. Verghese.	S. Majid Ali.
11.	Duplicate Bridge	L. S. Mani. R K. Ayyangar, P. S. Narayanaswami and T. V. Reddy.	P. K. Menon, S. R. Raju, V. S. Sankaran and P. V. Krishna Iyer.
12.	Progressive Bridge North—South	M. Mukundan and K. Santhanam.	E. J. Sivaswami and E. J. Verghese.
	East—West	A. K. Nambiar and B. Rangiah Pillai.	M S. Kylasam and K. Venkataswami.

Visitors Mr. H. M Hood, I. C. S. Second Adviser to H. E. the Governor of Madras, Mr P H. Rama Reddy, the Director of Agriculture, and Sri K. C. Naik, Fruits Specialist visited the Agricultural College and Research Institute during the month.

Weather Review—JULY 1941.

RAINFALL DATA

Division	Station.	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	5·1	−1·8	14·1
	Calingapatam	3·7	−1·6	10·3
	Vizagapatam	1·7	−2·8	14·4
	Anakapalli*	2·5	−2·5	13·3
	Samalkota*			
	Maruteru*	3·6	−4·5	15·1
	Cocanada	3·6	−2·2	33·7
	Masulipatam	1·9	−4·5	7·5
	Guntur*	1·1	−4·7	6·3
Ceded Dists.	Kurnool	0·9	−3·9	2·9
	Nandyal*	0·6	−4·4	5·0
	Hagari*	0·5	−1·4	4·0
	Siruguppa*	2·3	−0·8	9·2
	Bellary	0·7	−1·1	7·4
	Cuddapah	1·8	−2·1	8·4
	Anantapur	2·1	−1·3	4·8
	Rentachintala	2·5		5·7
	Anantharajupet*	0·1	−2·8	0·0
Carnatic	Nellore	1·6	−1·2	4·7
	Madras	1·1	−2·8	5·8
	Palur*	4·3	+1·3	9·4
	Tindivanam*	1·7	0·0	4·3
	Cuddalore	3·3	+0·2	10·1
Central	Vellore	0·7	−4·6	5·6
	Gudiyattam*	1·1	−2·4	4·9
	Salem	2·6	−1·2	12·3
	Coimbatore	1·3	−0·2	13·2
	Coimbatore A. C. & R. I.*	1·3	−0·8	14·2
	Trichinopoly	0·4	−1·2	3·9

Division	Station	Actual for month	Departure from normal @	Total since 1st Janaruy
South	Negapatam	1·1	−0·8	5·8
	Aduthurai*	1·3	0·0	6·5
	Madura	0·7	−1·2	12·1
	Pamban	0·0	−0·6	8·9
	Koilpatti*	0·1	−0·6	5·9
	Palamkottah	0·1	−0·3	7·5
West Coast	Trivandrum	10·3	0·0	46·1
	Cochin	15·0	−7·8	72·2
	Calicut	18·5	−11·7	86·6
	Pattambi*	18·2	−8·3	85·8
	Taliparamba*	20·5	−24·3	74·2
	Kasargode*	16·8	−25·2	72·3
	Nileshwar*	15·4	−27·6	79·0
	Mangalore	16·4	−20·7	51·4
Mysore and Coorg	Chitaldrug	1·8	−1·3	6·3
	Bangalore	3·4	−0·8	14·2
	Mysore	2·1	−0·5	18·2
	Mercara	31·9	−15·0	80·1
Hills	Kodaikanal	5·3	+0·3	21·0
	Coonoor			
	Ootacamund*	4·8	+1·3	21·6
	Nanjanad*	11·4	+0·9	32·3

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated up to 1937 (published in Fort St. George Gazette).

The monsoon was fairly active over the peninsula during the first half of the month under the influence of depressions which formed in the north of the Bay, but which moved in a more northerly direction than usual and failed to affect the weather over the peninsula to any marked extent.

A break in the monsoon set in about the middle of the month and continued for the rest of the month.

Rainfall was in large defect nearly over the whole area, with the exception of the Hills.

Day and night temperatures were generally above normal the highest temperature recorded being 104° at Rentichintala and Nellore on the 21st.

Weather Report for the Agricultural College and Research Institute Observatory.

Report No. 7/41.

Absolute maximum in shade	...	91·6°F
Absolute minimum in shade	...	68·7°F
Mean maximum in shade ...	...	87·5°F
Departure from normal ...	...	+1·0°F
Mean minimum in shade ...	...	71·7°F
Departure from normal ...	...	−0·6°F
Total rainfall for the month	...	1·27"
Departure from normal ...	...	−0·81"
Heaviest fall in 24 hours ...	...	0·34" on the 6th.
Total number of rainy days ...	...	5
Mean daily wind velocity ...	...	2·7 m. p. h.
Departure from normal ...	...	−5·9 m. p. h.
Mean humidity at 8 hours ...	...	73·0%
Departure from normal ...	...	+1·1%

Summary: The monsoon was active in the first half of the month. The rainfall was 1·27" which was 0·8" below normal. Skies were heavily clouded and the humidity was in excess The day temperatures were above normal while the night temperatures were slightly below normal. The wind velocity was far below normal.

P. V. R. & S. V. K.

Weather Review—AUGUST 1941.

RAINFALL DATA

Division	Station.	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	3·7	−4·1	17·8
	Calingapatam	3·3	−4·6	13·6
	Vizagapatam	1·8	−3·6	16·2
	Anakapalli*	4·1	−1·2	17·4
	Samalkota*	2·9	−3·5	22·0
	Maruteru*	4·5	−3·0	19·6
	Cocanada	1·6	−3·9	35·3
	Masulipatam	5·2	−1·7	12·7
	Guntur*	2·3	−3·0	8·5
Ceded Dists.	Kurnool	2·0	−3·0	4·9
	Nandyal*	3·2	−2·3	8·2
	Hagari*	2·0	−2·0	6·0
	Siruguppa*	2·5	−1·1	11·7
	Cuddapah	2·6	−3·2	11·0
	Bellary	5·0	+2·7	12·4
	Anantapur	2·5	+0·3	7·3
	Rentachintala	5·1		10·8
	Anantharaju-pet*	1·8	0·0	0·0
Carnatic	Nellore	1·5	−1·8	6·2
	Madras	2·1	−2·5	7·9
	Palur*	2·5	−1·9	11·9
	Tindivanam*	2·5	−2·4	6·8
	Cuddalore	3·9	−1·1	14·0
Central	Vellore	1·1	−5·2	6·7
	Gudiyattam*	4·0	0·0	8·9
	Salem	4·7	−2·1	17·0
	Coimbatore	1·5	+0·4	14·7
	Coimbatore A. C. & R. I.*	2·5	+1·3	16·7
	Trichinopoly	2·7	−1·1	6·6

Division	Station	Actual for month	Departure from normal @	Total since 1st Janaruy
South	Negapatam	0·7	−2·9	6·5
	Aduthurai*	1·1	−2·0	7·6
	Madura	5·0	+0·7	17·1
	Pamban	0·0	−0·7	8·9
	Koilpatti*	0·4	−1·3	6·3
	Palamkottah	0·0	−0·6	7·5
West Coast	Trivandrum	8·0	0·0	54·1
	Cochin	14·8	+1·9	87·0
	Calicut	18·0	+2·4	104·6
	Pattambi*	19·0	+4·2	104·7
	Taliparamba*	15·0	−8·6	89·3
	Kasargode*	15·0	−14·6	87·3
	Nileshwar*	11·4	−14·6	90·4
	Mangalore	23·2	+0·4	74·6
Mysore and Coorg	Chitaldrug	4·6	+1·6	10·9
	Bangalore	3·1	−2·3	17·3
	Mysore	6·2	+2·9	24·4
	Mercara	27·5	+2·0	107·6
Hills	Kodaikanal	5·1	−1·9	26·1
	Coonoor			
	Ootacamund*	3·9	+0·4	28·5
	Nanjanad*	6·4	−0·5	38·7

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated up to 1937 (published in Fort St. George Gazette).

The monsoon continued to be very weak over the peninsula almost throughout the month. The depressions which formed in the Bay were once again formed too far north and traversed a northerly path and failed to affect weather to any appreciable degree over the peninsula.

Towards the end of the month, conditions became unsettled off the Malabar Coast and thunderstorm activity increased over south east of the peninsula and south Deccan.

Rainfall was again in large defect over the whole area, the defect being most marked in the Circars, Ceded Districts and parts of the West Coast.

Temperatures were generally above normal, the highest maximum being 103° at Rentachintala on the 26th and Nellore on the 22nd and 28th.

Weather Report for the Agricultural College and Research Institute Observatory.

Report No. 8/41.

Absolute maximum in shade	...	91·5°F (27th)
Absolute minimum in shade	...	69·5°F (25th)
Mean maximum in shade ...	...	87·6°F
Departure from normal ...	...	+0·7°F
Mean minimum in shade ...	...	73·0°F
Departure from normal ...	...	+1·9°F
Total rainfall for the month	...	2·49″
Departure from normal ...	...	+1·30″
Heaviest fall in 24 hours ...	...	0·53″ (29th)
Total number of rainy days ...	...	7
Mean daily wind velocity ...	...	4·2 m. p. h.
Departure from normal ...	...	−2·7 m. p. h.
Mean humidity at 8 hours ...	...	72·5%
Departure from normal ...	...	−1·5%

Summary: Rainfall was in excess of normal due to thunderstorm activity towards the end of the month. Skies were generally heavily clouded. Temperatures were above normal and markedly so during the nights. P. V. R. & S. V. K.

Departmental Notifications.

Gazetted Service.

Appointments.

Sri. C. Ramaswami Nayudu, Junior Lecturer in Agriculture and Assistant Superintendent, Central Farm, officiating as Provincial Marketing Officer, will continue to officiate, during the absence of Sri. Rao Bahadur K. Gopalakrishna Raju on leave.

Sri. M. Chinnaswami Nayudu, Upper Subordinate, IV Grade, to act as District Agricultural Officer, Guntur, in Category 5, class I of the Madras Agricultural Service.

Sri. N. Subrahmanya Ayyar, Subordinate, IV Grade, to act as District Agricultural Officer, Sattur, in Category 5 of Class I of the Madras Agricultural Service.

Transfers.

Sri. P. Subrahmanyam, D. A. O., Saidapet, on relief by Sri. M. Subrahmanya Pillai to officiate as D. A. O., Cuddapah.

Sri. K. Venkatarama Ayyar, D. A. O., Cuddalore on relief by Sri. T. G. Muthuswami Ayyar to be D. A. O., Ellore.

Leave.

Sri. Y. G. Krishna Rao Nayudu, Acting Dy. Director of Agriculture, Cocanada, l. a. p. for 3 months from the date of relief.

Sri. S. Sitharama Patrudu, D. A. O., Cocanada, l. a. p. for 3 months from the date of relief.

Subordinate Service.

Transfers.

Name of officers.	From	To
Sri. K. C. Thomas,	F. M. A. R. S., Nandyal;	A. D., Tirupur.
„ Ch. Venkata Saravayya Chetty,	Marketing section under Govt. of India;	Rice Sub-Station, Buchireddipalem.
„ S. Ramachandra Rao,	Rice Sub-Station, Buchireddipalem;	A. R. S., Maruteru.
„ B. V. Ramana,	A. A. D., Tuni (on leave)	A. A. D., Itchapuram.
„ V. G. Venkataramana Rao,	Offg. A. D., Kalahasti;	Offg. A. D., Wallajah.
„ N. Sobhanadri,	Foreign Service under Tobacco Market Committee, Guntur;	A. D., Kavali.
„ M. Srinivasa Rao,	A. D., Kavali;	Foreign Service under Tobacco Market Committee. Guntur.
„ S. Kuppuswami Ayyangar,	A. D., Tindivanam;	A. D., Trichinopoly.
„ L. Krishnan,	A. D., Tanjore;	A. D., Tindivanam.
„ N. Krishna Menon,	Sub-Asst. in Entomology, Coimbatore;	For special duty at Vadavanur (Palghat).
„ S. Venkatarama Ayyar.	A. D., Sriperambudur;	F. M. A. R. S., Palur.
„ Y. Venkataswami,	Offg. F. M., Samalkota;	A. D., Vizagapatam.
„ G. Venkatakrishna Ayyar,	A. D.. Srivilliputhur;	F. M., Botanic Gardens, Coimbatore.

Leave.

Name of officers.	Period of leave.
Sri. S. Rangabrahmarao Nayudu, A. D., on Foreign Service under Vuyyur Sugarcane Growers' Co-operative Union,	L. a. p. for 2 months from 26—7—41.
„ M. Narasimham. A. D., Tenali,	L. a. p. for 1 month from 8—9—41.
„ K. S. Ramanna Rai, A. D., Harapanahalli,	L. a. p. for 1 month from 12—9—41.
„ V. Chidambaram Pillai, A. D., Sankarankoil,	Extension of l. a. p. on m. c. for 1 month from 29—8—41.
„ E. K. Govindan Nambiar. F. M., Horticulture, Coimbatore,	L. a. p. for 3½ months from 4—9—41.
„ N. Ramadoss. A. D., Ongole,	L. a. p. for 1 month from 28—8—41.
„ S. Mayandi Pillai, Asst. in Cotton, A. R. S. Nandyal,	L. a. p. for 3 months and 9 days from 15—9—41.
„ M. S. Purnalingam Pillai, Sub-Asst. Cotton Breeding Station, Coimbatore,	L. a. p. for 3 months and 14 days from 10—9—41.
„ K. Sitarama Ayyar, F. M. A. R. S. Pattukottai,	Further extension of l. a. p. on m. c. for 1 month and leave on half average pay for 3 month from 23—8—41.
„ Ch. Venkata Saravayya Chetty, Asst. in Paddy Section,	L. a. p. for 2 months from 1—9—41.

Sri. K. Krishna Hegde, A. F. M.	A. R. S. Nanjanad,	L a. p. for 1 month from 18—9—41.
,, S. Ramachandran, A. D.,	Koilpatti,	L. a. p. on m. c. for 2 months from 5—9—41.

List of officers deputed for the refresher course.

Names.	Designation.
Abdulla Haji, P.	A. D. Ponnani.
Annaswami Ayyar, A. K.	A. D. Sivaganga.
Antony, J. S.	A. A. D. Srivaikuntam.
Ayyaswamy Ayyar, T. V.	A. A. D. Ariyalur.
Bhima Raju, S.	A. D. Chandragiri.
Devasikhamani, T.	A D. Jammalamadugu.
Gopal Chetti, M.	A. D. Shiyali.
Gopala Rao M.	A. A. D. Vizianagaram.
Gopala Unnithan, M.	A. D. Tirupattur.
Gourisankara Ayyar, M. P.	A. D. Lalgudi.
Hanumantha Rao, D.	A. D. Pithapuram.
Kannan Nambiar, P.	A. A. D. Tellicherry.
Krishna Naik, S.	A. D. Kasaragod.
Krishnaswami Ayyar, C. S.	A. D. Chidambaram.
Krishna Reddy, T.	A. D. Nandyal.
Kunhiraman Nambiar, P. A.	A. A. D. Dindigul.
Lakshmipathi Rao, T.	A. D. Bimavaram.
Muthuswami Ayyar, S.	A. D. Tirukoilur.
Narasimham, P. L.	A. D. Bezavada.
Narayanan Nair, K.	A. D. Namakal.
Narayana Reddy, M. L.	A. A. D. Anakapalli.
Rajagopala Ayyar, N. S.	A. D. Krishnagiri.
Rama Rao, K.	A. D. Rayadrug.
Raman Menon, K.	A. D. Coonoor.
Rajarathnam Chetty, S.	A. D. Palladam.
Sambasiva Rao, P. V.	A. D. Kothapeta.
Sankarakumar Pillai, L.	A. D. Nanguneri.
Sakharama Rao, G.	A. D. Karkal.
Seshagiri Rao, K. V.	A. A. D. Hindupur.
Sitharama Sastri, G.	A. D. Gudivada.
Srinivasa Rao, N.	A. D Kollegal.
Subramania Ayyar, D. S.	A. D. Devakotta.
Subramania Ayyar, K. K.	A. D. Conjeevaram.
Subramania Ayyar, P. R.	A. D. Tirutani.
Suryanarayana, J.	A. D. Gurzala.
Suryanarayana, K.	A. A. D. Chapparupalli.
Suryanarayana, V.	A. D. Tadepalligudam.
Varadachari, K.	A. D. Gooty.
Varadarajulu Naidu, S,	A. D. Dhone,
Venkatarangam, A.	A. D. Rapur.

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EDITORIAL

Recent Research in India. The Society of Biological Chemists, India have just brought out an Annual Review of Bio-chemical and Allied Research in India for the year 1940. It contains as many as sixteen articles contributed by eminent scientists of the day on important subjects. A perusal of the review reveals that the year under review has witnessed many important advances in our knowledge on various subjects, and to the student of agriculture this knowledge is indeed very valuable. For a full information on general nutrition, the reader is referred to a very valuable compilation by Gangulee, N. "Bibliography of Nutrition in India", Oxford University Press, London. No less than forty papers have been published during the year on vitamins. In regard to adulteration of foods, the year under review had seen greater determination on the part of the public and the administrators to put down the practice of adulteration of foods and drugs. The enactment of the Drugs Act and the formation of the Central Committee for Food Standards (*Current Science*, 1940, 9, 439) were significant events of the year. The output of scientific work in this field is also very encouraging.

The increased interest on the subject of Animal Nutrition and Dairy Science was maintained during the year, as shown by the fairly large number of publications. The publication, "Indian Indigenous Milk products" by W. L. Davies, Thacker Spink & Co., Ltd., Calcutta, deserves mention. In plant physiology, much valuable work has been done on the applied side, namely, vernalisation, water relations, the influence of mineral elements, physiology of crops and fruits, environmental influence on plants etc. Very important contributions have also been made on germination and viability of seeds, respiration in light, carbohydrate changes in plant tissue, and photoperiodism and radiation effects upon growth of plants. In mycology also much good work has been done. Luthra has given a review of seed-borne diseases of agricultural crops, the damage done by them and their methods of control. He has specially mentioned the smut and bunt diseases of cereals. Research in entomology has also been very active and most of the papers have been published in the *Indian Journal of Entomology*. Mention must be made about the valuable contributions dealing with insect pests of cotton and sugarcane, two of the most important money crops of India. The very fact that there has been an impressive output in the field of soils, fertilisers and manures shows the continued interest in this line of research. The Imperial Council of Agricultural Research appointed an *adhoc* Committee of Soil Chemists in May 1939 to make recommendations for carrying out an All-India soil survey and

it is hoped that the Council of Research will shortly implement the recommendations made by the *adhoc* Committee. On the problem of soil erosion and its control, much valuable work has been done. Physical and physico-chemical properties of soils have also been having their due share of attention. Soil organic matter and carbon transformations, soil nitrogen and nitrogen changes, plant nutrition and crop growth, technique of plot experiments and statistical analysis, utilisation of waste products of the sugar industry in agriculture, manures and fertilisers, manurial practice and crop production, all these important subjects have been engaging the attention of the workers in this broad and very important field of research. '*An Agricultural Testament*' by Howard, published during the year, deserves special mention, in that, in this he embodies his wide experience with Indian agriculture and a careful study of its problems. The book points out very clearly that for the agricultural success organic manure is essential since it alone produces humus, and humus is requisite for the mycorrhizal symbiosis between the plant roots and the soil which extensive experience has apparently shown to be fundamental. Plants grown under proper agricultural conditions, with plenty of aeration in presence of humus, are shown to be disease-resistant, and animals, including human beings, fed on such vegetables are also resistant to disease. Considerable amount of work has been carried out both in the laboratory and on the experimental farm and numerous results obtained. Though the stage is not yet reached when the findings of the experiments could be passed on to the poor cultivator in the village for increased production—which is the aim of all agricultural research in India—there is the satisfaction that the forward steps in this direction have been taken and it is hoped the day is not far off when there will be the full achievement of this object. The present war necessitates our endeavouring more and more as conditions are such that we have not only to be self-contained but also help the Empire in its time of need.

Production of Food Crops. We wish to draw the attention of our readers to a Press Note from the Director of Agriculture published in this issue, which gives an estimate of paddy and food crop cultivation in the Presidency, and suggests ways and means of improving the production both in quantity and quality. In the Madras Presidency, though seventy-five per cent. of the area cropped is normally cultivated under food crops comprising paddy, millets and pulses, yet in 1939-40, rice was as usual imported from Burma, Siam and Indo-China, to the tune of nearly 9,00,000 tons. The difficulty in so importing rice under the present war conditions is also pointed out, and it is urged that every cultivator and landowner in the Presidency should bestir himself to increase the production of food crops from his holdings to the utmost by intensive and extensive cultivation. It is an earnest hope that absentee landlords, tenants and landowning cultivators of this Province will co-operate with one another and very seriously consider the problem of increasing the production of food crops, whereby they will be not only in a position to make our country self-supporting but also help the Empire.

Some Noteworthy Features of Fruit Industry in Rajampet Taluk.*

By T. K. VISWANATHAN, B. Sc. (Ag.)

(The Kodur Fruit Growers' Co-operative Society, Rajampet.)

Introduction. *Suitability of the tract for fruit industry.* Rajampet Taluk in Cuddapah District is one of the most important fruit growing areas of the Presidency. This valley is bounded by Velikonda hills on the east and south and Seshachalam hills on the north and west. This tract is favoured by a fertile soil of considerable depth, good texture, plentiful supply of sub-soil water suitable for irrigation, freedom from cyclonic winds and proximity to the Madras market—factors eminently suited for making this orange belt famous in South India. This valley is also famous for the number of varieties of mangoes, limes and Sapotas, which it grows. But the commercial importance of mangoes and limes is shared by Chittoor and North Arcot districts. The success of the fruit industry depends not only upon the quality of the fruit produced, and additional wealth it brings to the individual fruit-grower but also on the cheapness with which it is marketed so that it is made available to the poorest citizen of the province. The importance of fruit production and consumption of fruits in an essentially vegetarian country like India cannot be over-emphasised.

Extent of cultivation area. Out of nearly 13,000 acres under "Tight jacket oranges" in our presidency nearly 4,000 acres are spread out in this valley. The total area under mangoes in this taluk is estimated to be 10,000 acres. Fortunately for the fruit industry the plantation of oranges in Rajampet Taluk in Rajampet area lies in a compact region and this contributes to the success of Co-operative operating methods. The acreage under this commercial planting of oranges has been steadily increasing as is shown below:—

1937–38	2,412 acres
1938–39	2,751 »
1939–40	3,740 »

It is believed that about three-fourths of the orange trees are still young and in a non-bearing stage, and year after year the production of oranges will be increasing and the problem of marketing such saleable produce is bound to assume increasing importance.

Varieties. The Citrus varieties in Rajampet Taluk are:— 1. *Chinee* or Sathgudi or Sweet orange—*Citrus sinensis* (L) Osbeck, 2. Acid lime—*Citrus aurantifolia* Swingle, 3. *Kamala—Citrus chrysocarpa* Hort. Ex-Tanaka, 4. *Kichili—Citrus maderaspatana,* Tanaka, 5. *Gajanimma—Citrus pennivesiculata,* Tanaka, 6. *Pomelo—Citrus grandis,* Osbeck, 7. *Billi*

* Paper read at the thirtieth College Day and Conference of the M. A. S. Union, July 1941.

kichili—Citrus reshni, Tanaka, 6. *Jamberi—Citrus jambhiri*, Lush, 9. *Gabuchinee—Citrus species*.

The most common mango varieties are, *Neelum, Bangalora, Rumani, Mulgoa, Pether, Khudds*, and *Kalipad*.

Cultivation methods. (a) Opening of new orchards :— The orchards are raised throughout the taluk as the soils are fertile with sub-soil moisture and at the same time providing easy drainage facilities. The plants are obtained both from the private nurserymen as also from the Government nursery. Most of the present bearing orchards are from seedlings. But now there is more demand for budded and graft plants than for seedlings. The planting distance for orange trees is 25 to 30 feet. The budded and graft plants are not so spreading in habit and so are given less spacing. Limes are planted 12 to 15 feet apart. Intercrops are raised till the orange plants reach their fifth year. The usual crops grown are turmeric, *ragi*, green manure, groundnut, etc.

(b) Maintenance of existing orchards :— The quality of fruit produced can be improved by regular cultural practices. Regular and timely irrigations, manuring in proper seasons, regular cultural operations and keeping the orchards free from diseases are all factors which decide to a great extent the quality of the fruit. The well kept orchards not only give a regular and high yield but also produce uniformly good quality fruits.

(c) Manuring, irrigation, yield, diseases and pests :—

Manuring. One of the most popular manurial practices in Rajampet taluk consists of application of groundnut cake—$\frac{1}{2}$ maund ; bone meal—8 lb.; farm yard manure—$\frac{1}{4}$ to $\frac{1}{2}$ cart load to the bearing trees. In many orchards the application is done twice a year. There is a strong belief that the application in July stimulates the production of "gairangam crop" (second crop) which fetches a very high price in the fresh fruit markets. This special feature deserves to be exploited and popularised if it is found to be as efficacious as it is claimed to be. Investigation by research is required in this matter.

Irrigation. Irrigation of orange trees forms one of the most important practices on which however the growers in Rajampet usually possess no exact knowledge. The frequencies of irrigation, time at which it should be applied and the manner of application are all matters which vary from orchard to orchard. The influence of each of these on tree growth, fruit-shedding, tree yield and fruit quality requires to be investigated by research, so that the growers may have correct scientific information for their guidance in this important matter.

Yield. The yield of *chinee* trees varies widely. Some of the prolific bearers yield more than 3,000 fruits in the main season while poor yielders give not more than 100 fruits per tree. The performance of a tree can be greatly increased by proper cultivation, manuring, irrigation, spraying, etc.

But this improvement cannot be extended beyond a certain limit which is based on inherent characteristic of the parent tree.

Diseases and Pests. *Mottle leaf.* Disease seems to be very common in Rajampet taluk. Plants become weaker and yield is reduced. Spraying with zinc sulphate has been found to be useful. The Kodur Fruit Growers' Co-operative Society has purchased a sprayer and recently a spraying campaign has been started. Recent trials at Fruit Research Station, Kodur, indicate mottling may not be always due to zinc deficiency or may not always be cured by spraying of zinc sulphate. Application of several compounds like zinc sulphate, ferrous sulphate, manganese sulphate, boric acid and lime to soil, in small doses in a number of crowbar holes have been tried at the station with very interesting results. It has been found that some of the trees which do not respond to zinc sulphate spraying have been fully cured by this treatment.

Gummosis is also prevalent throughout the taluk. Application of Bordeaux paste after the removal of the gum and the bark with knife has been found useful.

Root rot. The whole tree becomes yellow and in course of time becomes weak, dries up and dies. Timely action such as digging up, exposure of the roots, removal of the affected and rotten roots and application of Bordeaux paste has proved beneficial.

The fruit sucking moth does havoc during the rainy season. Hand netting has been carried on by many orchard owners. The use of tomatoes as a catch crop has not been established, but is being advocated by the entomological section.

The flying foxes are a nuisance to growers causing a very heavy damage to orange crop. They are nocturnal in habit doing damage despite the owners engaging whole-night watchmen with guns. They usually prefer the biggest and the best sized fruits and when they fly from tree to tree and alight on fruit laden branches with their huge wings, cause more fruits to drop than are actually devoured by them and the fruits that drop down are unfit for export. Exploding devices such as crackers and guns helped little to scare away the birds. Fixing up of huge nets reaching great heights was tried as traps for these birds. A number of them were killed and the pest was fairly brought under control.

Oranges grown in different parts of India, present a striking contrast primarily due to climatic differences. Differences in varieties and seasons of maturity are likewise in sharp contrast. In Kodur area, for example, the fruit maturing season is from August to December, while in Rajampet area it is from November to March. Because of this difference in climate and soil, the fruit of the Kodur area cannot be safely kept on trees, beyond December, while those in Rajampet area can be kept till the end of March. Ecological considerations play therefore a very great part in influencing the

flowering of oranges. The second season fruits called the *gairangam* fruits (from June to August) are more profuse in Kodur area than in Rajampet area. This remarkable variation in time of blooming, fruiting and harvest in such closely situated areas as Kodur and Rajampet are not only of scientific interest but also of considerable practical value in that Rajampet Taluk is blessed with conditions very favourable for the harvest of oranges over a protracted period of the year.

The fruits of different seasons, *angam, gairangam* and *edagaru* need only to be briefly differentiated. The fruits of the main *angam* season taste much sweeter, are better coloured, more attractive and juicier than the other two off-season fruits. Despite the inferior quality of the off-season fruits they possess high market value and therefore form a highly welcome feature of the orange cultivation in this tract.

Although the orange trees in this taluk uniformly produce a very high crop of blossoms every year, the very frequent occurrence of heavy shedding of the flowers and fruits in the orchards results in keen disappointment to the growers. These annual losses are believed to be caused primarily by certain physiological disorders about the exact nature of which the growers are yet in the dark. Irregular and unstandardised cultural practices may certainly predispose the trees to these serious maladies and there appears to be a great scope for the horticultural advisers to educate the growers in the matter of improvement of these orchard practices.

Harvesting. The usual practice is to pull the fruits from the branches of the trees. The fruits are thrown down and are received by a man standing beneath the tree. This throwing of fruits is harmful in that though the fruits are not apparently damaged at that time, still they show dark patches and rot due to the hard compact. Hence fruits should be received in a canvas bag held by the person who picks the fruits on the tree.

The fruits owned by members are picked by coolies employed by them. The harvesting problem is two sided:—

1. The fruit must be handled carefully at all times.

2. Each picker should pick a sufficient quantity to keep the labour costs within reasonable limits.

1. Ladders are used to reach the heights of trees. As mentioned above while harvesting fruits a uniformly careful handling should be ensured. The fruits should not be injured during various operations. Careless handling results in a loss to the producer.

2. If the harvest is begun the practice in Rajampet taluk is to pick all the fruits of the trees in that particular row, with the result fruits of various degrees of maturity and sizes are harvested at the same time. But on the other hand if a garden owner were to go round each tree and pick such fruits which are best sized and properly matured it is impossible to keep labour costs within reasonable limits. It is a difficult problem to keep a

desirable relation between quality and quantity of the work. This quantity —quality work is secured through trained labour and more efficient supervision.

The picking cost also depends upon the size and age of the trees, the size and quality of the crop and lastly on the fruit season, weather and whether the crop is *Angami, Gairangam* or *Edagaru* crops. In the main *Angam* season the picking cost is much lower than during the *Gairangam* or *Edagaru* seasons. Thus the reduced yield in each tree in the off-season increases the picking cost.

After the harvest is over the fruits are taken in baskets to a packing shed. Here the fruits are spread on the floor, hand graded and counted and packed in baskets. The fruits were used to be packed with green leaves. But these spoil the fruits earlier due to the moisture they contain. Hence dry straw is now advocated as packing material. This is now being largely practised. The number of fruits in a basket depends upon the size of the fruits and varies from 60 to 90 per basket.

Marketing. Co-operative marketing vs. individual effort.

There is a widespread belief that if planting of gardens goes on at the present rate, fruit growing would soon become unprofitable as fruits will sell very cheap due to overproduction. This is entirely erroneous and is based on the misunderstanding of the whole situation. Our country with its varied climatic conditions and soils and cheap labour should be able to build up a decent trade in fruits. While there is a great room for improvement by (a) increasing average tree yield (b) improving the quality of the fruit and (c) reducing the cost of production there are ways for getting increased profits from orchards by reducing the middlemen's profit and undertaking co-operative marketing and ensuring a uniform distribution for a longer period. This can be achieved only by adopting co-operative methods and not by individualistic efforts. The success achieved by the Kodur Fruit Growers' Co-operative Society makes a study of the organisation of more than usual value.

In Rajampet taluk, as perhaps in the rest of the fruit growing areas of India, the common practice with small garden owners is to sell the fruits on trees to contractors or middlemen for one or even more seasons. The contractors are therefore responsible for picking, packing, and marketing the fruits, and usually do it in a manner suited to them not caring for the interests of the garden. They keep the fruits in the garden till very late in the season in order to get better prices, with the result trees get spoiled, manuring operations are delayed and irrigations become irregular and the flowering of the next year's main crop is considerably affected and the yield consequently reduced. In many cases the contractors when in need of money from the commission agents, gather immature fruits and spoil the market due to bad quality fruits. But in horticulturally advanced countries the fruit growers not only look to production side of fruits but take

very keen interest personally in marketing them. The co-operative organised efforts give them an opportunity to control the trade and regulate the distribution to suit the demand at any particular market.

It is perhaps not too much to say that the Rajampet fruit growers at present think that their responsibility ends with mere production of fruits and play almost no part in the further marketing of the same. This is because watching expenses are saved and other agricultural operations for crops like paddy, jonna and turmeric besides dry crops like horsegram demand their attention. Ignorance of marketing technique and lack of information regarding the market, stand in the way of their directly marketing the fruits.

But after the inception of the Kodur Fruit Growers' Co-operative Society during the year 1937 many have found the benefit in the society. In certain big areas like Nagavaram and a number of villages the entire produce goes through the society. Temporary advances are made by way of loans. The society has established fruit sale depots at Anantapur, Hindupur, Bangalore and Hyderabad. But the bulk of the produce goes to Madras from where the fruits are further consigned to southern districts like Madura, Tanjore, Trichy, etc. The progress of work done by the society during the year 1940—1941 is as follows:—

Particulars.	*Baskets.*	*Gross sales.*
1. Oranges	36,095	
2. Mangoes	2,561	
3. Limes	802	
4. Melons	1,763	Rs, 1,63,408.
5. Sapotas	10	
6. Pineapples	184	
7. Betel leaves	30,418	

The society is undertaking from 1—8—41 one of the important functions of grading oranges at two important fruit growing areas and from these ware houses directly consign them to moffussal areas. The cheap, simple and efficacious "Kodur Chinee grader" devised at the Fruit Research Station, Kodur, which helps to grade the fruits into four sizes, namely, $2\frac{3}{4}''$, $3''$, $3\frac{1}{4}''$ and $3\frac{1}{2}''$ will be used. The grading stations will also help to teach the growers the proper methods of harvesting, gathering, culling, grading and packing.

The society addressed the M. S. M. Railway authorities and got concessional rates for oranges to Madras, Bangalore, Anantapur, Hindupur and Hyderabad stations. The society is also moving the S. I. R. and M. S. M. Railway authorities to grant concessional rates to all important towns in South India.

Scope for improvement. The Fruit Research Station located in the important orange tract has already become very useful to growers in giving very valuable suggestions of a practical nature. Many of the intelligent growers are convinced that in due course results of research that is being carried on at the station will be of far reaching importance in removing

various uncertainties in the prevalent methods of orange culture, particularly in the matter of selections of stock, lay out of orchards, methods of cultivation, treatment of diseases, etc.

More intensive research in Fruit Canning and By-products are required as the work now being carried on at Kodur Research Station seems to be very much hampered, for lack of facilities. It is very difficult to rely on private nursery men but the growers throughout the Province are able to get the "real" plant from the Government nursery. But it is regretted that the Government is not at present able to raise enough plants to meet the demand and it is requested that the Government may be pleased to give necessary facilities. We are glad to note that the Government has decided to appoint a Fruit Specialist for our Province who will devote all his attention for improving the Fruit Industry.

On behalf of the Kodur Fruit Growers' Co-operative Society I have tried to present in this paper some of the salient features of the fruit industry in Rajampet taluk. I am sure it will be clear to all that there is a good deal to do towards making the fruit industry as prosperous as it has a right to be. The activities of the society has contributed its share to effectively ameliorate the condition of the growers. But this is not all. In the interest of the fruit growers who form a most important section of our rural population and in the interest of a still larger class of fruit consumers the society pleads for much greater assistance from the Government. While on the one hand we demand a marked extension of research and advisory activities on fruits, on the other we plead for more active assistance, by way of annual subsidy and also assistance in the matter of exploration of new markets and establishment of sale depots throughout the Province and outside, and an all-round extension of transportation facilities and of reduction of railway freights for our fruits. These are but very modest requests and we hope that they will be readily granted by the Government.

A Note on the Marketing of Cotton in the Regulated Cotton Markets of Berar and Bombay Presidency.

By M. JEEVAN RAO, B.Sc. (Ag.)

Secretary, The Adoni Cotton Market Committee.

In the following lines the marketing conditions in the regulated markets of Dhulia in Bombay Presidency, and Amraoti, Akola and Khamgaon in the Berar, are briefly summarised. Although the markets visited are but a few that are working in the Bombay Presidency and the Berar, they are the most important ones, and the conditions prevailing in these markets may be taken as representative.

Amraoti Market.

Of the regulated markets in Berar, the biggest is Amraoti with an annual transaction of about 1¼ lakhs of bales of cotton. This is a municipal market, and classified as a first class one. Amraoti is the headquarters

of the Commissioner, the Deputy Commissioner, the Deputy Director of Agriculture and various other Government officers. The place is situated at a distance of 6 miles from Badnera junction and is the terminus for the branch line Amraoti. The regulated cotton market in this place is constituted under the "Berar Cotton and Grain Markets Law of 1897" and its later amendments. The management of the market is vested with a committee consisting of 11 members, of whom one is from the District Council, one from the Municipal Council, one from the Cotton Sale Co-operative Society, four from cotton growers' constituency and four are from the cotton traders in the notified area. The chairman is elected from amongst the 11 members of the committee. There is a technically qualified secretary for the committee.

There were 40 registered buyers, 96 registered commission agents and 58 licenced independent weighmen, for this market at the time of the writer's visit.

The market is situated in the heart of the town in a site of about seven acres enclosed by a masonry compound wall and provided in all with six gates for the entry and exit of carts laden with cotton. At the main entrance is the Cotton Committee office building, the second floor of which is used as the council hall for holding meetings. There are buildings in the market yard for the accommodation of traders, agriculturists, commission agents etc. A reading room is also run with the committee funds within the market yard for the benefit of the public. The sanitary arrangements are excellent, and there are water troughs for cattle, and godown accommodation for keeping about 4,000 cotton bales. The secretary is provided with quarters in the market yard and adjacent to his, are situated quarters for a peon and a watchman. In the centre of the market is a neat and well kept park of about one acre in extent.

Working of the Market. The market opens at 5 A.M. The carts with kapas and cotton from the various villages, enter the market yard by the main gate and as they enter the commission agents or their nominees meet them and direct them to the stand allotted to the respective commission agent. If the cartman does not like to sell his produce through a commission agent he stands separately.

By about 6 A.M. when all the traders and commission agents would have come to the market yard, the committee publishes on the notice boards in prominent places in the market yard, the Broach and Oomra rates, with Liverpool and New York futures. According to the limits of their purchases the buyers open the rate for the day and inform the committee the range of prices. This is immediately published on the notice boards by about 6-15 A.M.

Then regular trading starts. The buyer goes to each of the carts examines the stuff and quotes his rate for the same under cover, the seller's commission agent acting as the intermediary. When the commission agent

thinks that it is a fair bargain, he informs the cartman accordingly. It is only when the cartman, who has previous instruction from his master accepts, that the commission agent openly declares the price for that cart and fixes up the same. Immediately an agreement form is filled up in duplicate. This contains the name of the buyer, the name of the seller, his village, district etc., rate per candy fixed and signatures of the commission agent and the purchaser. This form along with the committee's fee for the cart, (Rs. 0—1—0) is taken to the counter of the Market Committee office, where both the copies are signed by the committee servant. One copy is returned to the grower with the token for the cart for having paid the cart cess of Rs. 0—1—0. Most of the transactions in this manner are completed by about 8-30 A. M. The carts that were given the tokens find their way to the compounds of the various buyers or to the gin compounds, where weighing takes place. The tokens are handed over to the gate keeper, who shall not allow the carts to go out without returning them. The rate fixed in the agreement at the market yard is final and cannot be altered unless it be that the stuff is very bad inside and this be agreed upon mutually. Else these disputes are settled by the committee's secretary as per rules.

For example if a buyer, who fixed the rate for a cart of kapas in the market yard, finds the stuff to be of inferior quality or a mixture while weighing, he claims a reduction of rate with the consent of the seller's commission agent and the ryot, convincing them of the inferiority. If the ryot is not willing for the reduction, he has the option to complain to the committee for intervention, or sell it elsewhere or get it ginned. The commission agent gets his commission only when the full transaction gets settled. No deductions are allowed in kind.

Weighment. This is done by licensed weighmen, who are not servants of any private cotton concern or the committee; but are remunerated as per By-laws. No weighman is allowed to practise in a particular compound for more than a week continuously. The weighment is done in units of 56 Lbs. As soon as the kapas in the cart is weighed, the weighman gets the weights entered in the weighment book in the prescribed form and sends a copy of the same to the Amraoti Cotton Market Committee. Then the commission agent gets a *consolidated bill* from the buyer.

The agent draws the amount and pays the individual cartman or agriculturist in a prescribed form which is maintained in triplicate. One copy is given to the cartman, one is sent to the committee office and the third retained by him. The commission agent should by the above returns, account for in full the amount drawn by him from the buyer, to the satisfaction of the committee.

If the cartman is not desirous of selling his stuff the same day, he takes a token from the office paying one anna, stating that he is going to deposit the stuff in a ginning factory for either storing or for ginning. When kapas or lint is stored in godowns, actual charges are charged to the ryot. The

token is given at the gate of the market yard and the cart finds an exit. The gin owners after ginning, write on each *dokra* of lint, the date of ginning, name of the owner, name of ginning factory, gross weight of the *dokra* and weight of *batar*. When sale of lint takes place the transactions are settled on the above weight. But if the purchaser doubts, he can re-weigh them. Such instances are said to be very few. The market yard is clear of carts by about 3 P. M., when sweeping and cleaning are done and the market is kept tidy to receive the next day's arrivals.

Charity. No deductions are made but the Amraoti commission agents have formed into an association and pay to a charity fund one anna per every rupee of commission drawn.

The following appear to be the good points in this system of marketing: (a) The buyer, the commission agent and the seller have ample opportunities to examine the stuff and fix up rates. (b) For the commission received, the commission agent does really some amount of good to the ryot as well as to the buyer and the dealings are plain. (c) The payments are received the same day both by the commission agent and by his clients. (d) Better stuff gets better prices whatever might be the ruling market rates, thus inducing the ryot to get un-adulterated stuff. (e) The illiterate ryot is not lured with *a high price* for his produce and later subjected to enormous deductions. (f) The buyer has the satisfaction of having paid for the quantity and quality of stuff he requires. (g) The market committee has all opportunities to check the genuineness of the transactions. Thus weights are checked through the weighman *chitta,* and the rates offered through the agreement form signed in the market yard before taking the token for the cart. The consolidated bill handed over to the commission agent gives the details of that day's transactions by the buyer with the commission agent. The commission agent is responsible for disbursing the full amount received from the buyer, to the owners of cotton in full after making the deductions of amounts due to the commission agent, and this can be checked with reference to the receipts given by commission agents to the individual agriculturists.

This in brief is the system of marketing adopted in the Amraoti regulated cotton market in Berar. It is gratifying to note from the various reports of inspection of this market, recorded in the visitors' book, that the working of this market is excellent and that there is much co-operation between the buyer, seller, commission agent and the staff of the market committee. This market is opined to be the biggest kapas market in the world.

The Akola and Khamgaon markets are run on similar lines as that of Amraoti with the following main differences.

Akola Market.

The tokens issued to cartmen are of tin on which paper labels bearing the date are pasted, and they become obsolete for the next day. The market yard is about 4 acres in extent, and its capacity is about 60 to 70 thousand

bales per year. 14 buyers and 71 commission agents have registered themselves in this market. There are 78 licensed weighmen. The market does not start so early as in Amraoti.

Khamgaon Market.

The rates for the day are opened by a panel of three representatives from buyers, three from commission agents and one from the market committee. They closet themselves in a room, consider their limits of purchases and then declare the rates.

Deduction for moisture alone is allowed in the shape of weight.

There are in this market :— Registered buyers 15. Registered adityas 70. Licensed weighmen 65 (independent).

The market yard is 10 acres in extent enclosed by wire fencing, and the transactions average about 80,000 bales per year.

Dhulia Market of the Bombay Presidency.

The market at Dhulia in the Khandesh district of the Bombay Presidency is constituted under the Commercial Crops Markets Act of 1927 of Bombay and subsequent amendments. The act is similar to Act XX of the Madras Presidency. In this market, no person shall expose for sale or cause to be exposed unginned cotton or cotton waste at any place within the area of the market i. e., four miles from the centre of the market yard, other than the area declared as Cotton Market Yard. This market, I am told, is the biggest regulated market in Bombay Presidency, transacting annually 50 to 60 thousand bales. Here also the prices are offered by seeing the stuff in the market yard. No deductions in weights are allowed. After the bargain is struck in the market yard, an agreement as at Amraoti is signed and token from the market committee after paying the cart cess. The rest of the procedure is as at Amraoti.

The extent of the market is eight acres. The Dhulia market differs from the Amraoti Market in the following points :—

(1) There are commission agents for buyers as well as sellers, of course if the buyers and sellers so desire.

(2) The tickets (tokens) are punched as the carts get out of the market. Punched tickets cannot be used again.

(3) The commission agents make payments to the ryots even before they receive payment from the buyers. The commission agent is solely responsible for the payment of money to the ryot, for the produce, which he had caused to be sold to a buyer through him.

(4) *Pinjrapole*. This is charged at Rs. 0--2—6 per *boja* (392 lbs.) of lint, by the gin owners, when kapas is ginned by them. This amount is collected from the owner of kapas. For the purpose of this charge the owner of kapas is one, who has purchased the kapas in the market yard i. e.,

the buyer of kapas. If a ryot gets the kapas ginned in his own name only, without selling he pays *pinjrapole* charges after the ginning of the kapas.

When sales of cotton take place in the gin compounds, a report about the sale is sent to the Market Committee at Dhulia the same day in the form given.

The following general features are noted in all the markets :—

1. A commission agent is one who does not buy cotton either in his name or in partnership with others, which he sells as such agent; but he makes or offers to make a purchase or sale of any commercial crop or does or offers to do anything necessary for completing or carrying out such purchase or sale, on behalf of another person and in consideration of a commission.

2. All the licensed weighmen are independent and are not servants of any particular firm or person.

3. All samples are paid for.

4. Deductions are made only in terms of Rs. as. ps. in rates, except for moisture in Khamgaon.

5. The weighman *chitta*, the traders' purchase and sale accounts of the day and the commission agents' actual disbursement bills' duplicates are sent to the Market Committee, the same evening or by next morning for check.

Conclusion. One is very much impressed by the atmosphere of mutual trust and honesty in which all the transactions are being effected in these markets. There appears to be absolute co-operation and harmony amongst the sellers, buyers, commission agents, and growers. If these good points are adopted in all markets it will benefit all the classes of traders and enhance the prestige of the market.

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Cultivation and Marketing of Virginia Tobacco.

By K. SANKARAIAH

Village Munsiff, Thumadu, Kandukur, Nellore.

"Economics of Farming" is a subject not well known to many an Indian farmer. Of all crops, production of flue cured Virginia Tobacco, otherwise called cigarettee tobacco, is one which should not be attempted or continued if once begun, without studying its economics. In the Madras Province as elsewhere in India, the crop was first introduced by the Indian Leaf Tobacco Development Co., Ltd., some 15 years ago in the black cotton soils of the Guntur district, where it has occupied the whole tract and has also extended to Nellore, Kistna and Godavari Districts. (Vide. *Report on the Marketing of Tobacco in India and Burma—Page 31—A. M. A. 10/1400 Central Government.)* The ryots know only how much they get over the acreage they plant. They do not know where they err and fail to get deserving profits ultimately. They do not care to know where and how money should be advanced and skilled labour be made available. In this article I propose to deal more with the economic aspects of flue-cured tobacco.

In the districts named above, this has become the main crop that pays the agriculturist in the shape of money owing to its universal demand. The value of all omissions and commissions in doing a right thing will tell upon the nett profits, hence cultivation and marketing of the crop have to be studied under eight heads:—

1. Nurseries.
2. Manuring and preparation of land.
3. Transplantation and gap filling.
4. Interculture.
5. Topping and suckering.
6. Harvest and flue-curing.
7. Grading and marketing.
8. Pests and diseases. (Non-recurring.)

Nurseries. In raising nurseries the following have to be attended to, manuring, preparation of beds to obtain a fine tilth, levelling beds with drainage channels around, sowing seed, hardening the beds, watering, rougeing, thinning, repairing drainage, top dressing of manure and application of Bordeaux mixture at intervals. The different operations can be done by a fixed number of labourers engaged for the whole season. It has to be explained how several duties can be performed by one set. The work has to be done gradually and slowly with due care. The whole area should not be sown on one and the same day for the reason that pulling the seedlings for planting has to be done at the same time when land may not be ready. The grower may not be able to command sufficient labour in the busy season of transplantation and rains may not permit him to carry on transplantation

every day. So, it should be the look out of a nursery man to have seedlings on a small scale, say about 10,000 a day. If plants are available in the beds beyond the planting capacity of the grower, they over grow, which will eventually affect the quantity and quality of the yield. Watering seed beds should be done from 8 A.M. to 4 P.M. while the working hours are from 7 A.M. to 5 P.M.; every day we have an hour in the morning and one in the evening to divert the attention of the labourers for weeding etc. Besides on rainy days, when no watering is necessary, thinning out, repairing drains etc., should be attended to.

In 1939-40 I incurred the following expenditure, for raising nurseries in 25 cents of pure sandy soil and 20 cents of sandy clay soil. I engaged only two coolies per plot as water was available in the middle of each plot with a lift of 10 ft.

Cost of raising seed beds in 1939-40.

Particulars.	Rate.	Sandy soil 25 cents.		Sandy clay 20 cents.	
		Quantity.	Value Rs.as.ps.	Quantity.	Value Rs.as ps
Cattle manure	Rs. 0-12-0 per ct. ld.	6 cart loads.	4-8-0	4 cart loads.	3-0-0
Preparation of beds ...	Rs. 0-4-0 per head.	2 men on 8 days.	4-0-0	2 men on 8 days.	4-0-0
Collections of dry casurina leaves to cover beds.	do.	1 man on 1 day.	0-4-0	1 man on 1 day.	0-4-0
Sowing, watering etc. till pulling	do.	2 men on 90 days.	45-0-0	2 men on 90 days.	45-0-0
Cost of seed	Rs. 1-8-0 per lb.	8 ozs.	0-12-0	7 ozs.	0-11-0
Am. Sulphate-top dressing	Rs. 5-6-0 per cwt.	100 lbs.	4-12-0	80 lbs.	3-12-0
Total. ...			59-4-0		56-11-0

Number of seedlings obtained in proper season (27-10-39 to 22-11-39)	1,22,700	90,700
Cost of 1000 seedlings	0-8-0	0-10-6

Inferences:— 1. Average cost of 1000 plants is 0-9-3.
2. Sandy soil is the best.
3. One cent of seed bed gives 5000 plants to plant one acre planted at 3′ apart.

The site for the nursery should be changed from year to year. Secondly the surface soil of the beds should be sterilised by burning trash over it before preparing it for sowing.

Manuring and preparation of land. It is important that the land should be thoroughly ploughed thrice, so that the artificial manure supplied to the land may be well incorporated into the soil and also a fine tilth is made for root development and preservation of moisture. Assuming that the previous manurial treatment and rotation are carried out as for any other crop, it is found necessary to apply artificial fertilizers to get mainly

the required quantity of Nitrogen, Phosphoric acid and potash. Most of the soils are deficient in these three plant foods. Hence artificial fertilisers are used. Some companies like Messrs. Parry & Co. and Shaw Wallace & Co. are the manufacturers of tobacco manure mixtures and the mixture costs Rs. 33 per acre. The analytical data of the fertilizer or the component ingredients are not revealed to the public, but is kept as a matter of trade secret. Hence I am not able to arrive at the proper value of the tobacco manure mixture. But reliable information on the subject of manuring of tobacco is available in (1) Indian Farming—September 1940, (2) Indian Farming—December 1940, (3) Indian Farming—April 1941, (4) Madras Agri. Journal—January 1941, (5) Madras Agri. Journal—March 1941, (6) J. A. R. I.—7—187 by Shaw & Kashi Ram., (7) Tobacco Culture by Taylor.

Expenditure per acre.

1.	Cost of fertilizer (360 lbs.)	33	0	0
2.	Clearing the land for cultivation	0	1	0
3.	Drilling in the fertilizer with ground gorru for 1 day @ Re. 1/- per pair plus extra man sowing the fertilizer.	1	4	0
4.	Three ploughings with country plough local rate (1 pair ploughs ¾ acre a day)	5	0	0
5.	Harrowing finely with gorru twice and once with Guntaka and marking with the marker.	1	4	0
	Total cost per acre.	40	9	0

Transplantation. Transplantation is to be done only in the evenings. Nothing can be done in the mornings except pulling the plants from the beds for evening work and this is done by seed-bed coolies without extra charge. Planting is done 3′ apart from plant to plant and row to row, to encourage full development of leaf. Moreover a good spacing is very convenient for intercultural operations.

1.	Five women transplant 5000 plants in one acre @ Re. 0—2—0 per day per head	0	10	0
2.	Picking seedlings and supplying—one woman	0	2	0
3.	Watering the plants if there be no rain that day or the previous day	1	4	0
4.	Cost of seedlings per acre as arrived at before	2	14	0
	Total cost per acre	4	14	0
5.	Gap filling @ 10% of transplantation cost	0	8	0
	Total cost per acre	5	6	0

Interculture. Intercultivation is done to eradicate weeds that come up after transplantation and create mulch which will not allow the sub-soil water to evaporate. Interculture commences a fortnight after transplantation by which time the plants take root firmly. From January to 15th March intercultivation should be done once in ten days. The cost of interculture is as follows :—

1.	Six times intercultivation at 4 annas per acre	1	8	0
2	Hand picking of weeds that remain around the plant after interculture 3 times @ 2 annas per acre	0	6	0
	Total.	1	14	0

Topping and Suckering. In case of flue-curing tobacco, topping is not usually done. It should be done only when it is known that the soil contains phosphoric acid sufficiently or when the crop development is poor. If done otherwise, the crop produces dark and coarse leaf which is unfit for flue curing. Topping too high may not give the desired result. Whether high or low, the cost of topping and suckering is the same.

1.	½ man for topping an acre @ 4 annas per man	0	2	0
2.	Six suckerings in the year @ 4 annas each suckering per acre	1	8	0
	Total cost	1	10	0

N. B.—The above cost includes removal of tops and suckers to the manure pit.

Harvest and Flue Curing. Priming is an operation done before harvest and intended to remove the bottom most perished leaves which are very light and poor in quality. Such stuff will not pay even the cost of curing. If priming is done, access to free air to the bottom of the plant is made and chances for the insects to hide underneath are reduced.

One man clears one acre in ½ a day. Harvest of ripe leaves which have attained orange yellow colour, is done in two or three stages according to the number of leaves borne on the plant. The interval between two harvests will be about 15—20 days. Lower most leaves are removed first and at each harvest the number removed per plant would be about 8—10. The leaves are collected in the evenings, and carted to the site of the barn and are made ready overnight for loading the barn the next day.

Barn construction. The first step in flue-curing is to have a good barn. The inner dimensions of a double furnace barn and a single furnace barn are 20′ × 20′ × 18′ and 16′ × 16′ × 16′ respectively, the thickness of the wall being 1½′. The bottom most tier should be 7′ above the ground level and the vertical distance between two tiers should be 2¾′, and they are arranged 4 feet apart. Terraced roofing is said to be better than corrugated sheet of iron. The cost of barn construction is given with a view to arrive at its depreciation value which is 10% on the capital cost. The annual depreciation value is divided by the number of probable curings in a year which may be taken as eight. On arriving at such a value per curing it can be calculated for 1 candy (500 Lbs.) of cured leaf which is the product of 5 candies of green leaf, this being the average yield per acre. Thus we arrive at the depreciation value to be added to 1 acre crop. (Vide A. R. I. Bul. 187, page 16.)

Construction of a bran and other equipment on contract basis at pre-war rates.

	Specification.	Double furnace Barn.			Single furnace Barn.		
1.	Foundation—2′— concrete lime mortar—Brick walls—20′ × 20′ × 18′ × 1½′ thick-etc.	435	0	0	300	0	0
2.	Causurina tier poles 22′ long @ 1½ rupees each.	45	0	0	30	0	0
3.	Roofing with corrugated Iron sheets.	135	0	0	95	0	0
4.	Ventilators 12 (1½′ × 1′).	30	0	0	25	0	0

5.	Flues (24 gauge steel sheet)	60	0	0	30	0	0
6.	Furnaces @ Rs. 135 each.	270	0	0	135	0	0
7.	Wet and Dry bulb hygrometer.	12	0	0	12	0	0
8.	Curometer.	2	8	0	2	8	0
9.	Petromax light.	12	8	0	12	8	0
10.	Salter's spring balance. 300 lbs.	22	0	0	22	0	0
11.	Lathis 4½′ long ⅜″ diameter @ Rs. 12 per thousand.	36	0	0	36	0	0
12.	*Misc. equipment.* Mats 50—Dietz lanterns 3—shovel, stirrer—time piece—torch light—leaf weighing baskets—thatched shed 25′×12′ etc.	56	11	0	33	0	0
	Total. Rs.	1116	11	0	733	0	0

N. B. Cost of pandals not included as they will be used for housing cattle in summer.

Calculation of Depreciation Value.

	Particulars.	D. F. Barn	S. F. Barn.
1.	Capital cost,	1116 11 0	733 0 0
2.	Depreciation @ 10% per annum.	111 11 0	73 5 0
3.	,, per curing (8 curings per year.)	14 0 0	9 3 0
4.	,, per acre.	7 0 0	9 3 0

Yield in one acre is taken as five candies and D. F. Barn holds 10 candies and S. F. Barn 5 candies of green leaf.

Curing the Leaf. The next step is curing the leaf. A double furnace holds 5000 lb. of green, that is the yield of two acres; while a single furnace one holds only 2,500 lb., the yield of one acre. On this basis expenses for curing are worked out. Though the figures of the ratio of the cured leaf to green leaf is 1:4·1 as per my records (Vide infra), I adopt the general opinion that it is 1:5. My result was obtained by maintaining optimum relative humidity and temperature in the barn as far as necessary the leaf having been in good condition. The ratio varies from season to season, soil to soil, and also according to the precautions taken at the time of curing. The curing expenses are as mentioned below :—

	Particulars	D. F. Barn 5000 lbs.	S. F. Barn 2500 lbs.
1.	Leaf picking-stringing-loading, unloading and bulking @ 1—8—0 per candy—(500 lb.)	15 0 0	7 8 0
2.	Two firemen for 5 days @ six annas per day	3 12 0	3 12 0
3.	Curer for 5 days @ 1 per day	5 0 0	5 0 0
4.	Coal with cartage 1 and 1¼ ton @ 14—8—0 per ton	18 2 0	14 8 0
5.	Rope 2 maunds for 3 curings @ Rs. 5 a maund	3 5 0	1 10 0
6.	Kerosene oil for 1 petromax light-2 nights —1½ as. a day	0 3 0	0 3 0
7.	Kerosene oil for 3 Dietz lanterns for 5 days @ 0—4—0 a day	1 4 0	1 4 0
8.	Torch 3 cells for 3 curings 0—9—0/3	0 3 0	0 3 0
	Total curing cost,	46 11 0	34 0 0

In a D. F. Barn curing cost per acre yield 5 candies of green leaf		23 6 0
In a S. F. „ „ „		34 0 0

To the above add :—

	D. F. Barn.	S. F. Barn.
Priming.	0 2 0	0 2 0
Depreciation.	7 0 0	9 3 0
Curing costs as mentioned.	23 6 0	34 0 0
Total.	30 8 0	43 5 0

Statistics of coal consumption.

Green leaf cured.	Coal consumed in lbs.
4586 lbs.	2278
5442 lbs.	2730
5415 lbs.	3026

7. *Grading and Marketing.* Grading is the final operation that determines the profit of the grower. Any slackness, intentional or un-intentional, will be an advantage to the purchaser since he will be ready to point out only defects to reduce the price on that score. The grading work is being done on a contract basis as follows :—

1.	Grading and packing force 500 lb. of cured leaf @ Rs. 3 per candy of 500 lb.	3 0 0
2.	Gunny—8 bales for 8 grades	1 0 0
3.	String @ 0—1—0 per bale—8 bales	0 8 0
4.	Supervising maistry over 10 graders—one day	0 4 0
5.	Cart hire to market—6 miles	1 0 0
	Charges for grading and marketing	5 12 0

While marketing, the purchaser offers a price and the seller may accept it if he likes. The rates are very fluctuating as may be seen from the following data.

1. ˙he average price per candy of 500 lb. Rs. 173 0 0
2. The average return per acre (2500 lb. green leaf). 208 8 0
3. The ratio of cured to green leaf 1:4·1
4. The percentages of grades in cured leaf are as follows :—

I Grade.	19 40%	III Grade.	16·70%	V Grade.	Nil.
II „	35·50%	IV „	18 50%	VI „	9·90%
		Total.	100·00%		

N. B.—Rate means cost of 500 lb. of cured leaf in the statement.

Grades,	Sale No. 1. 2620 lb. Green leaf.			Sale No. 2. 2635 lb. Green leaf.			Sale No. 3. 2667 lb. Green leaf,		
	Rate. Rs	Wt. lb.	Value. Rs. as.	Rate. Rs.	Wt lb.	Value. Rs as.	Rate. Rs.	Wt. lb.	Value. Rs as.
1	298	227	135—5	340	85	57—13	315	59	37—3
2	174	135	46—14	199	213	84—9	138	333	91—12
3	201	143	57--8-	186	125	46—7	190	55	20—14
4	55	44	4—13	60	55	6—10	92	255	46—15
5	125	17	4—4	—	—	—	—	—	—
6	55	35	3—14	66	93	12—5	78	60	9—6
Total	—	601	252—10-	—	571	207—12-	—	762	206—2-

1934 lb. of cured leaf costs :— Rs. 666—8—0.
500 lb. of cured leaf costs. Rs. 176—0—0.
1934 lb. of cured leaf is obtained from 7952 lb. of green leaf.
Therefore the ratio of cured to green leaf is 1 :4·1.
7952 lb. of green leaf paid Rs. 665—8—0.
2500 lb. of green leaf paid Rs. 206—8—0 from one acre.

Finally let us find out the nett profits per acre as follows :—

Particulars.	Receipt per acre. Rs. as. ps.	Production cost. Rs. as. ps.
Average return for 1 acre-2500 pounds of green leaf	208 8 0	
Cultivation expenses per acre		40 9 0
Cost of seedlings and transplantation		5 6 0
Interculture		1 14 0
Topping and suckering		1 10 0
Priming, harvest (Flue-curing)		30 8 0
Grading and marketing		5 12 0
Total	208 8 0	85 11 0
Nett profit		122 13 0

If the leaf is cured in a single furnace barn the expenditure under curing is greater by about Rs. 12—13—0 i. e. nett profit will be less by this amount. In either case a deduction of land revenue has to be made as for the prevailing rate.

Pests and diseases. Besides various items of expenditure there is one other item i. e. control of insect pests, the cost of which depends upon the nature and extend of incidence.

During 1940—41 the nature of the crop was such that in spite of the most unfavourable year affected by abnormally heavy rains and insect damage the nett loss per acre came to Rs. 43. The average return per acre for both 1939—'40 and 1940—'41 comes to Rs. 40. Such bad years are very rare.

Though the nett profit per acre, i. e. Rs. 40, is higher than that for any other crop, considering the skill, intelligence, labour, time devoted and capital invested it is low for Virginia tobacco crop. It will be very profitable to grow this crop if the market and the quality of the produce are improved. It is worth doing. Though failures are sometimes inevitabe, in favourable years it pays amply to meet the cash requirements of the agriculturists.

A Note on concentrated Seed Beds and Double transplanting of Paddy in the Nellore District.

By A. GOPALAKRISHNIAH NAIDU, L. Ag.

District Agricultural Officer, Nellore.

In the Nellore District, most of the tanks usually receive their full supply of water in October – November, after the break of the north-east monsoon. Sometimes, even the Kanigiri and other major reservoirs fed by the Pennar river irrigating nearly one hundred and fifty thousand acres, do not regularly get their full supply of water in July—August. In spite of these uncertain conditions of water supply, ryots persist in cultivating a long duration variety of rice called *Molagulukulu* for the reason that it sells at a comparatively high price and its quality is good. The yield of *Molagulukulu* when planted in July—August is high. However, its yield under late-planted condition is poor, and such late planted crops are invariably susceptible to the disease known as 'blast' *(Piricularia oryzae)* which is more or less endemic in the district. Consequently, ryots are forced to cultivate an inferior coarse variety of red rice known as *Isvarakora* or be contented with growing a crop of *ragi*, or other dry crops even though water is available in plenty late in the season. The demand for *Molagulukulu* rice, otherwise known as Nellore rice, in the market from upper and middle class people of the towns of the Southern and Central districts of the Madras Presidency is steady throughout the year. In the interest of the rice growers of the Nellore district and consumers in the urban areas of the Presidency, it is very necessary to increase the total output of *Molagulukulu* crop, as otherwise limited production would either tend to increase the price of this high class rice, or when price trend is downward, would lead to adulteration of the limited good quality rice with cheap inferior quality rices.

Apart from the improvement in the local *Molagulukulu* variety from the point of its yielding capacity and resistance to disease, the best way of tackling this problem of ensuring the cultivation of the long duration *Molagulukulu* variety on a larger scale in the district, appears to be to make the best use of the existing natural facilities of water supply by adopting the system of double transplanting. The principle involved in the double transplanting system is that the initial sowing of the seed bed should take place in the proper season, and thereafter the seedlings should be so reared that overgrowth is avoided or checked by proper control till finally planted out. Under the present conditions the interval between the date of sowing in the seed bed and final planting is too long and if left in good condition in the seed bed itself, the seedlings would become overaged and unfit for planting or if water is completely withheld the death rate of seedlings would be very high. In order to overcome this, it is suggested that the seedlings from the primary seed beds are to be planted out in a secondary nursery of

about 3 or 4 times the area of the first nursery. The planting of the seedlings in the secondary nursery gives a set back to the growth of the seedlings and at the same time it makes the seedlings, with better environment, grow hardy and robust to get over adverse weather conditions after they are finally planted late in the season.

Normally, about 5 acres of seed bed area are required to transplant 100 acres. Under the double transplanting system, seedlings from the primary seed beds are planted out in 15 to 20 acres which is the secondary or intermediate seed bed. Seedlings from this secondary nursery are then planted in about 100 acres. The proper season for sowing *Molagulukulu* in the first nursery in the delta area is first week of July *(arudrakarti)*. Seedlings are allowed to grow in the first nursery for about 6 weeks before being planted in the secondary nursery, wherefrom they will be again fit for final planting in about 4 or 5 weeks. As one of the objects in this system is to conserve the limited available water supply to the best advantage, it is advised that the seed bed area under a canal or in a village should be as far as possible concentrated along the main channels. In the tank-fed areas the seed beds are similarly raised except that the first sowing may have to be delayed to the end of August or early September. If water supply to maintain the primary and secondary seed beds are not available in these areas, the ryots in the nearest delta area can make a trade in raising seedlings to supply their adjacent *ryots* cultivating paddy under tanks. Both the primary and secondary seed beds are to be prepared under wet conditions. Seedlings in the primary seed beds should not be allowed to grow more than a foot in height and if a tendency to overgrowth is noticed at any time it is better to withhold irrigation for a week or two prior to planting the seedlings in the secondary nursery. Seedlings pulled from the primary seed beds are to be planted very close, in twos or threes, in the secondary nursery so that all the seedlings are accommodated within the small area prepared as the intermediate seed bed. The secondary nursery should be maintained under wet conditions.

The adoption of the double transplanting system, wherever facilities are available, will enable the Nellore ryot to grow the long duration variety *Molagulukulu* in a larger measure than at present even in tank-fed areas, and eliminate to a great extent the inferior variety *Isvarakora*. In the Pennar delta this system will enable the *ryots* to grow a green manure crop in a portion of his holding during the period the seedlings are in the two nurseries. Further, the planting period can be prolonged to adjust the work to the limited available labour without detriment to yield. They can also raise seedlings for sale to the *ryots* of the non-delta areas.

This method was tried in small areas in a number of villages in the Nellore district in 1940–41 season. The results were quite encouraging to pursue the trial on a wider scale in the coming season. This system will be particularly useful to the Mopad project. Till now the largest area ever cultivated under this *ayacut* is 6,300 acres, in 1925–26, though the proposed

ayacut is 12,500 acres. The average area cultivated for the last 20 years is only 4,000 acres, and by raising paddy seedlings in concentrated seed beds and double planting them all the 12,500 acres can be brought under paddy cultivation with the limited quantity of water.

Summary. Double transplanting system is an expediency cultural practice to get over the adverse seasonal conditions in the Nellore district, for the cultivation of the quality rice *Molagulukulu* even late in the season in the place of *Isvarakora*, an inferior rice variety. If the principle of the system is properly understood and carried out on a co-operative basis, so far as seed beds are concerned, the limited water supply in the major reservoirs, minor tanks or wells, early in the season, may be economically utilised for rearing the primary and secondary seed beds in the proper season, and thereby ensure a normal crop even when finally planted late after the tanks get their supply with the break of the north-east monsoon.

EXTRACTS

The possibility of extending Cinchona cultivation in the British Empire *By Sir Geoffrey Evans.* The Cinchona plant is the base for the manufacture of quinine, which is still the most important specific for malaria, in spite of the advent of synthetic drugs, such as plasmoquene and atabrine. The former drug is not now in favour, as it is said to give rise to certain toxic effects. Atabrine is of German origin and is protected by patents. Its cost is high, and it is stated that the cost of treating one malaria case with it would be 49 *sh.* as against 1 *sh.* for a similar treatment with quinine. It is remarkable that about 90 per cent. of the quinine products consumed in the world to-day is produced in the Netherlands East Indies, and that only about 4 per cent. is made in British countries. It has been estimated that there are some 800 million people in the world to-day who suffer from malaria and that there are two million fatal cases annually. A large proportion of these casualties are British subjects. For example, the League of Nations Health Organization gives data showing that 100 million people in British India alone suffer from malaria, but only 8 to 10 million are treated annually, and in other tropical parts of the Empire conditions are much the same.

The increased consumption of quinine is largely a matter of price and, running concurrently of efficient propaganda. With lower prices, a wider knowledge of the nature of the drug and efficient means of distribution, the consumption could undoubtedly be largely extended. India alone consumes about 210,000 lb. of quinine per annum, of which 70,000 are produced in the country and 140 000 are made from Dutch East Indies bark. The real need for India is provision for 100 million sufferers, using 45 grains a year, which would require 600,000 lb. of quinine sulphate annually.

The price of the bark is the real crux of the question, and this is largely controlled at the present time by one organization which holds a practical monopoly, namely, the Kina Bureau of Amsterdam. This controls the production of bark in the Netherlands East Indies, a region which, as has been stated above, provides not less than 90 per cent. of the total world production at present. The supplies from the South American countries which are the original home of the plant, are now negligible.

The genus *Cinchona* is a native of the Andean region and grows in a wild state on the eastern afforested areas of that region, between latitudes 10°N and

9°S., in the Republics of Peru and Bolivia. There are 65 species of the genus *Cinchona* listed in *Index Kewensis*, and all are characterized by possessing bark containing the quinine alkaloids to a greater or less degree. The classification has presented some difficulty to botanists, owing to the ease with which the species hybridize with one another, so giving rise to different forms. There are, however, only four species which are, or have been, cultivated to any extent for their alkaloids. These are *C. ledgeriana* Mones ex Trinen which is also known as *C. calisava* Wedd var., *ledgerina* Howard from which Ledger Bark is obtained; *C. succirubra* Pavon ex Klotzech, which produces Red Bark; *C. calisava* Wedd., yielding Yellow Bark; *O. officinalis* Lin., giving Crown Bark or Loxa. Nowadays practically all the Cinchona bark of commerce is obtained from *C. ledgeriana* and *C. succirubra*. Cowan gives the following average percentages of the three main species as grown in India:

	Quinine.	Other alkaloids.	Total alkaloids.
C. ledgeriana	5·49	3·03	8·52
C. officinalis	2·93	2·07	5·00
C. succirubra	1·40	4·85	6·25

Analyses of the bark indicate that *C. ledgeriana* is richer in quinine than any other species, but that *C. succirubra* possess a high total content of alkaloids, particularly in cinchonidine. These facts are of great importance in connection with the establishment of the planting industry, as naturally efforts have been made to cultivate *ledgeriana* on account of its high quinine-content, in spite of the fact that it is more particular in its requirements and is less easy to grow than the other species.

Today the Ceylon industry is dead. In India, the position was in some ways similar to that in Ceylon, with the difference that Government-owned plantations were maintained in the Nilgiri Hills of Madras and in the North-East of Bengal on the Sikhim border. These two regions are still the centres for quinine production in India, but private enterprise has ceased and only the Government plantations remain. At the height of the boom in 1880 it was estimated that the Government and private plantations in the Nilgiris and other parts of Southern India amounted to 5,800 acres, with a production of 400,000 lb. of dry bark per annum. In all parts of India the slump in prices caused by over-production saw the elimination of private plantations during the next decade.

There were essential differences in the management of the Government plantations in Madras and Bengal. In Madras, the policy had been to grow *succirubra* and to a less extent *officinalis* and *robusta*—species possessing a much lower quinine-content than *ledgeriana*, because conditions of soil and climate seemed to suit them better than *ledgeriana*. In Bengal, on the other hand, the value of *ledgeriana*, on account of the high quinine content of its bark, was realized from the time when the first small consignment of seed had been secured with so much difficulty, and efforts were largely concentrated on the problem of establishing this species, so that up to the present time by far the greater part of the area is still planted with *ledgeriana*.

In India the sequence of operation is as follows:— A suitable area of virgin rain-forest is selected and felled during the cold season (November to March). If steep, this land is terraced and staked 4 x 4 feet to mark the sites of the young trees which are planted out from the nursery beds in specially prepared holes during May and continuing for the next two months when rainy conditions prevail. In Darjeeling light shade-trees only are needed, but heavier shade is

required in Madras and Burma. Seedlings are raised and used as plants, and although experiments with grafting have been made, the practice of planting out seedlings still prevails in India. The soil of the nursery-beds is carefully prepared from leaf mould collected from the forest. It needs to be worked to a fine consistency, since the seed is very small and light and one ounce will give 20,000 seedlings. It germinates in about three weeks. The nursery-beds are sheltered by sloping roofs of thatch to protect the young seedlings from heavy rain or sun, and seeds are sown in March. They must be carefully watered with a fine spray at regular intervals. The seedlings are transplanted twice, first when the seed-leaves are just fully expanded to a distance of 1 inch apart, and later at the age of three months, in May and June, when they are 2 or 3 inches high, and then spacing is 3 x 3 inches. They are planted out after they have been in the nursery for two years, and a fortnight before they are transplanted, the roofing of thatch is gradually removed to harden off plant. The young plantation is cleared about twice a year for the first two or three years, but later periodical hoeing round the tree is all that is required. Harvesting of the bark begins about the fourth year when thinnings and prunings are dealt with. The final uprooting is made in the 10th year, as the figures indicate that a ten-year rotation gives the greatest return in quinine per unit of area. At the final harvest the whole tree is uprooted and the bark stripped from roots, stems, and branches which is then dried, stored, and passed to the factory. This method is said to give better results than a system of coppicing, which has also been practised.

Research has played a vital part in the Java industry from the early days. In a recent report to the Imperial Council of Agricultural Research for India, the need for systematic research on similar lines in India is stressed. It is recognized that the soil conditions and rainfall distribution is not so favourable in India as they are in Java, but it is believed that a properly organized research station ought to be able to raise the percentage to seven within a reasonable time.

Attempts to graft *ledgeriana* on to *succirubra* stakes in India have met with indifferent success up to the present. but it is suggested that three-quarters of the failure is due to ignorance of the correct technique. In Java, trained artisans can make over 200 grafts a day with an astonishing degree of success, and there seems little doubt that with perseverance and due encouragement, similar results ought to be obtainable in India.

In India the present position is that the possibility of extension in Bengal is very limited, whilst in Madras new areas are being tried out in the Anamalais, and a recent report by Wilson and Mirchandani indicated that enough first class land existed for an early resumption of *Cinchona-growing*, about 38,000 acres of first class land being available in Bengal, Assam, Orissa, Bhutan, Sikhim, Madras, Mysore and Coorg. The production of *Cinchona* by planters has now practically ceased. The old plantings in the Darjeeling district have long ago been replaced by tea and those in Southern India have been grabbed up and abandoned or replaced by coffee or some other crop. Further recent attempts to interest the planting community in this crop have not proved successful. A manifesto addressed to the Government of Madras by the Planters' Association, as lately as August 1938, laid down the following conditions as essential to any such project :—

1. A guarantee to absorb the production from *Cinchona* estates, provided the bark is of good quality.

2. A guarantee to pay the market rate subject to a fixed minimum.

3. Partial remission of land assessment on areas planted with Cinchona for a certain period.

4. The planters to guarantee not to sell their bark to anybody except the Government.

5. Government to have the right to limit the areas to be planted.

The matter of a guaranteed minimum price had been the subject of repeated representations from 1895 onwards, and finally in 1925 the Government refused. Accordingly, after an agreement with the Planters' Association, new lands in Anamalai Hills were opened up by Government in 1925 in order to supplement the supply of bark from the Nilgiri plantations. These new plantations appear to be doing well and unlike other areas in South India, the *ledgeriana* species seems to be doing better. There the matter rests at present.

(*Emp. Jour. Expt. Agric.* Vol. IX, No. 34, 1941.)

Increasing the feeding value of cereal straws. *By S. J. Watson.* Straw in its natural condition can be used to some extent to replace the hay that was fed in pre-war conditions, but its value for this purpose can be increased greatly. In its early stages the digestibility of the cereal plant is high. At this stage, the digestibility of the cell-wall cellulose is about 80%. As the cereal plant matures lignification takes place. Lignin, which is not digested by farm animals, is deposited around nitrogen free extractives (soluble carbohydrates) and protein and it protects them from the action of the digestive juices. Though straws are fairly rich in mineral matter, a high proportion of this is of no value to animals.

Straw is often chaffed and mixed with pulped or fingered roots, wet grains, wet beet pulp or molasses, and is allowed to stand for some time in a heap. This results in a partial softening of the straw itself, but there is no evidence of any appreciable increase in feeding value. To achieve the latter, the following simple process was adopted for farm use.

200 lb. of chopped straw were immersed in 200 gallons of 1·5% solution of caustic soda and left for a period of about 20—22 hours at the ordinary temperature. In the treated straw, cell-wall swells up and the cell cavity is filled up. The cells are separate and distinct and the surface layer of cells has broken down and these structural changes facilitate the digestive agents to act on all parts. Trials with sheep have confirmed the increase in digestibility. The starch equivalent value in the different treated straw-pulp is nearly doubled after the treatment.

The farm plant for treating the straw consists of a soaking tank without outlet, a ramp on which the treated straw pulp is allowed to drain and a tank used for washing the straw.

Where large quantities of straw pulp are fed, the stock should be provided with rock salt and a suitable mineral mixture of steamed bone flour and precipitated chalk to correct the deficiency in lime. *Jour. Roy. Soc. England.* Vol. 101.

Studies in soil cultivation. IX The effect of inter-row tillage on the yield of potatoes. *By H. C. Pereira.* Three primary comparisons were made for three years. In one, the weeds were removed without any appreciable mulch being produced. In the second, the weeds were removed by grubbing, thus maintaining fine tilth. The third was the usual practice in preliminary grubbing and then a second grubbing followed by earthing up. A second object of the experiment was to find the effect of surface mulching on the moisture content of soil.

In 1937, four times grubbed and ridged up plots gave 12·36 tons per acre while the no-grubbing plots gave 12·33 tons. Thus inter-row grubbing appear, to benefit the crop only in the removal of weed competition. The sub soil ploughing had no effect on the crop yield or size of tubers. The most striking result of

1938 experiment is that the means for the four weed free motor hoed treatments showed no response by the crop to 6 cultivations, 2 cultivations and no mulching. Ridging does not appear to encourage the crop. The extra grubbings produced little or no effect although there is a slight indication that the treatments may have effect when given earlier.

The blocks receiving 2 grubbings and 2 grubbings plus hand elimination of weeds showed the deleterious effect of weeds in the early stages of crop growth. In one case the reduction in yield was 43·4%. Competition for moisture was the principal reason for weed damage.

In the 1939 experiments, the grubbing depths were varied to include both 3 and 6 inches. This year also, where weeds were removed, there was no response to grubbing and earthing up. The weedy plots gave a significantly lower mean yield than the weed free plots.

The correlation (r. 0·263) between weed density and reduction in yield is insignificant for 8 pairs of values.

The fertiliser placement did not appear to give any marked effect on any of the treatments, though there was a suggestion that the effect of weed competition was less noticeable on the yield when the fertiliser was placed closer to the plants.

A study of moisture contents in plots receiving frequent mulching and no-mulching showed a mean loss of 0·26% moisture in 1937 and a mean gain of 0·22% in 1938, both the data being within the experimental error. The three years' results from 1937 to 1939 showed a mean reduction of 0·06% of moisture in un-mulched soil. The mulch thus had absolutely no effect on the moisture content of the first 18 inch of soil. Mulching may, however, cause a definite loss of water as compared with clean weeded land if the water table is near the surface; this is against what the traditional capillary hypothesis would predict. Mulching does conserve moisture if the comparison is made between clean mulched land and weedy land. *Jour. Agri. Sci.* Vol. 31, Part 2, April 1941.

Gleanings.

Sources of Tobacco Diseases. Diseases rank as one of the major problems in the production of tobacco. To assist the growers in this connection the Dominion Experimental Farms Service and the Laboratory of Plant Pathology of the Science Service, Harrow, are carrying on extensive research work, state R. J. Haslam, Assistant Superintendent of the Experimental Station, and L. W. Koch, Plant Pathologist in charge of the Laboratory.

In the case of those diseases where the causal organism is definitely known, source of an outbreak on a grower's farm can often be traced to some improper practice. In this connection the seed, plantbed and crop residue have been found to be potential sources of infection for the more common diseases. Few diseases are borne by the seed kernel, but chaff particles or foreign material mixed with the seed may be the cause of carrying disease organisms such as leaf spots and mosaic into the plantbed. It is advisable, therefore, to sow seed of good germination that has been properly cleaned.

Frequently during the late summer and autumn, weeds are found in and around tobacco beds. These are often the source of certain tobacco diseases because certain weeds are subject to the same diseases as the tobacco plant, and in the presence of either appropriate weeds or tobacco plants disease organisms tend to accumulate. As a precautionary measure, therefore, plantbeds should be cleaned up as soon as transplanting is completed. Weeds that appear later

in the season should be destroyed together with trash that tends to collect in and around the beds. Cleaning up practices are most effective if carried out in advance of steaming the soil, because disease organisms that enter the soil after steaming meet with less competition from harmless organisms and, therefore accumulate more rapidly. Unless these precautionary measures are taken, the money expended on steaming may be lost.

Tobacco beds situated adjacent to the curing barns are likely to be contaminated from tobacco residue which sometimes is allowed to accumulate inside the barn. When the tobacco is removed from the barn for stripping, any residue remaining should be cleaned up. If diseases such as mosaic and leaf spot have been a menace in previous years, it would be advisable to shift the location of the tobacco beds or disinfect the inside of the barn and any woodwork around the beds with a 2 per cent solution of formaldehyde. This will remove the possibility of the beds becoming contaminated.

Tobacco stalks, if not properly handled, may be a source of infection for mosaic and leaf diseases. In the case of flue-cured tobacco the stalk cutter and a cover crop of rye are recommended rather than leaving the stalks dry and uncut during the winter months. Stalks from air-cured tobacco should not be spread on fields where tobacco will be grown the following year.

Finally, the tobacco grower should be careful not to throw diseased tobacco materials into manure piles later to be applied to prospective tobacco ground, since leaf spots and mosaic may be spread in this manner. *(Indian Farming,* 2:440 and 441, 1941.)

Grass Seeding by Airplane. In the United States the airplane is now used as a seed planter as well as an insect duster in pest control. The Soil Conservation Service is credited with the bright idea. A lot of rough country had to be grassed, and ordinary methods of seeding were found either impracticable or too costly. With a 20-inch rainfall it was considered that a good growth of grass could be obtained and which would provide a protective cover which would be useful in preventing surface soil wash, as well as good grazing for stock. The question arose as to the best way of broadcasting grass seed over a large area, and it was decided to try seeding by aeroplane. An air-line firm took on the job, and for the purpose reconstructed the interior of a small cabin passenger plane, making room for a hopper with a capacity of 500 lb of grass seed. Test flights were made with the hopper loaded with sawdust, to see how the idea was likely to work. Further test flights were made using grass seed, and the seed distribution was checked on long strips of muslin. The tests proving satisfactory, actual seeding of a large area was carried out by flying at a height of 300 to 500 feet, so that the grass seed was distributed in a swathe about 100 feet wide. The flight lines used were 100 feet apart and the country was cross-seeded to ensure proper distribution. A man on the ground indicated the flight lines to the pilot checked the distribution of the grass seed and flag-wagged the plane from the job when the wind scattered the seed too widely. The best times for seeding were found to be from daybreak until about 10 o'clock in the morning and from about 4 o'clock in the afternoon until dusk. Altogether about 6,000 lb of grass seed was broadcast in ten hours of flying time distributed over three days. The area seeded was just under 3 000 acres. Both distribution and germination of the grass seed were considered highly satisfactory. The cost of seeding was not too much and should be considerably less for large areas and for country not so broken. Whether adaptable to other conditions or not, or even if the method is regarded as fantastic, the tests and their practical application provided a lot of useful information and established the feasibility of adding one more peaceful and beneficial use for the airplane.

(Queensland Agri. Jour. Vol. LVI, Part I, July 1941.)

Minor Elements in Sewage. At the Milwaukee (U. S. A.) sewage disposal plant dried activated sludge is produced at the rate of 100 tons per day and sold as a fertilizer.

The results obtained from the use of this material indicated appreciable benefits apart from those due to the 6 per cent. of nitrogen and 2·5 per cent. of available phosphoric acid present in the material.

These results were most noticeable in very sandy soils, where striking benefits from the use of boron, copper, manganese and zinc had been reported. It was, therefore, believed that these minor nutrient elements might account, at least in part, for some of the favourable effects produced by the sewage product.

An extensive series of analyses of the material revealed the presence of twenty-three elements, a number of which are concerned in plant nutrition. Significant amounts of boron, copper, manganese and zinc were found to be present in an available form as determined by extraction with a solution of carbonic acid. The results of the investigation showed clearly that, when used as a fertilizer or as a constituent of mixed fertilizer, the sewage product can serve as a source of the minor nutrient elements required by plants.

[*Agri. Gaz. New South Wales*, Vol. 52: 374, 1941].

Reviews.

Report on the Marketing of Eggs in India and Burma, *Abridged Edition*, issued by the Agricultural Marketing Adviser to the Government of India. Manager of Publications, New Delhi. Price 8 annas.

The readers of the Madras Agricultural Journal will remember that the Agricultural Marketing Adviser to the Government of India published last year his report on the marketing of eggs in India and Burma and that we published under abstracts in the February number of 1941, pages 74—78, salient features in the report. The abridged report serves a very useful purpose in that it gives in brief the noteworthy features dealt with in detail in the main report so that this edition is of special interest to schools, poultry farms and other institutions connected with the development of cottage industries and rural development. The Agricultural Marketing Adviser has brought out the abridged edition not only in English, but also in Hindi and Urdu, and these are also priced only eight annas a copy and are available at all Government Book Depots and in the Office of the Manager, Central Publication Branch, New Delhi. It is needless to point out how invaluable the Hindi and Urdu edition must be to the masses who cannot read English. Apart from the fact, the introduction, the inter-chapters and the final chapter of the main report are reproduced in this, various questions arising out of the plates, diagrams and maps are directly answered and these bring out most of the salient points of the main report. However, if one wishes to have fuller information on any point, the relevant portion and appendices of the main report must invariably be consulted—*Editor.*

Report on the Marketing of Tobacco in the Madras Presidency, by K. Gopalakrishna Raju and S. N. Venkataraman; Superintendent, Govt. Press, Madras. Price Rs. 2/8.

It may be remembered by the reading public that in the year 1939 the publication of an All-India Market Report for Tobacco was issued by the Agricultural Marketing Adviser to the Government of India. This was taken advantage of and the report of the market survey of tobacco in the Madras Presidency which

was first prepared in 1936, has been now made up-to-date and released for publication. The readers of the Madras Agricultural Journal may also call back to their minds, the interesting facts and figures that were published on the marketing of tobacco under Agricultural Jottings in the April issue of 1938, pages 144 to 148. Since that date more information has been gathered on the subject and this publication, which has brought them all together and put them in a manner that could be easily understood by the layman, is a valuable asset to the tobacco grower. It is most interesting to note that the Madras Province produces annually about 250 million pounds of tobacco, which is a fifth of the Indian production, and in material value it works to a figure of 5 crores for Madras while the figure for the whole of India is 18 crores. Taking into consideration the total exports, in 1938-39 the figure for Madras was 89 million pounds. Exports are made up of both manufactured tobacco products and raw tobacco. From the report, one can easily see what an important money crop tobacco is. The most important feature of tobacco cultivation in this Presidency is the remarkable expansion of cigarette tobacco, which it may be remembered, has had its small beginnings in 1920 and since then rose to a lakh of acres during 1938—39. It is a matter for pride that the entire crop of Virginia tobacco in India is from this Presidency. The report gives detailed information in regard to several aspects of marketing from the producer on to the final consumer or manufacturer, and contains several valuable facts and figures which throw plenty of light on the subject. For a quick grasp of the report it is suggested the reader refers to inter-chapters at pages 52; 74; 96; 110; 122; 130; 138; 150; 157; 175 and 182. The last inter-chapter, contains a beautiful summary of conclusions and recommendations—*Editor.*

Correspondence.

To

The Editor, The Madras Agricultural Journal.

Sir,

Tamarind seeds as Manure.

In some parts of the Salem District there is a concentrated production of tamarind. In Krishnagiri, the seeds are fried in pans over a fire and the husk removed by pestle and mortar. The husked seeds are exported for cattle food and the husk used as manure. At Palacode, in the Dharmapuri taluk, whole seeds are used as manure for paddy. Ten to twenty bags of seeds are spread in the puddle before transplanting. These rot in the course of a few days and get incorporated in the soil. It is said that these form good manure especially for alkaline soils. It is reported that tamarind seeds contain 2 to 2·5% Nitrogen and 0·4 to 0·5% Phosphoric acid and thus possess a manurial value.

R. Chockalingam Pillai,
District Agricultural Officer, Salem.

To

The Editor, The Madras Agricultural Journal.

Sir,

Glimpses into Rural India.

It is needless to say that the present days are so hard that there is a very keen struggle for existence everywhere, and no one feels the pinching hunger in a greater measure than does an average villager. A kind-hearted man may give the hungry something to satisfy their hunger at a time. The next day the hunger will be there and another man out of generosity may do the same, but hunger, an eternal trouble, will always be there with perhaps, none to help at all

times. It is, therefore, wise to find out ways and means to get sufficient from one's own soil to satisfy his hunger and meet other requirements of his daily life. The usual cry, 'improve the lot of the villagers', which we hear from press and platform bears testimony to the realization on the part of the Government and the leading class of men, of the hunger and distress the villagers are subject to. Efforts are being made to some extent by the Government and many dutiful sons of this mighty land of India to relieve the villagers from this distress. But this is not enough.

Any amount of food or cash will not help a villager unless he is taught to help himself in this struggle to lead a life free from distress We. villagers, today, are wasting a great deal of our wealth through ignorance. Wealth equivalent to crores of rupees is drifted into the Bay of Bengal and the Arabian Sea through soil erosion. Exposure of the farm yard manure to the scorching sun pelting rains brings about the loss of fertility worth millions of rupees every year. An average villager finds the quantity of manure the same before and after its exposure to the sun and remains in blissful ignorance of the loss of ammonia which is so vital to the production of a profitable crop. The house and farm refuse which can be composted and profitably used to enrich the soil generally accumulate around the houses and afford breeding place to mosquitoes which transmit many diseases to their victims, the villagers. The average villager today is so poor and ignorant that he cannot realise the huge waste that takes place around him every day. One who opens the eyes of an ignorant person to see the loss he suffers and educates him to avoid it. does much more to relieve him from distress than the one who freely gives him food from time to time. Human excreta when handled carefully and used to enrich the soil will add to the national wealth by at least fifty crores of rupees in this country, every year.

After learning to prevent wastage, there remain many things the study of which will help to add to the usual income of the villagers. Improved seeds in the place of the ordinary ones in crop production will increase the income of the *ryots* by ten to twenty percent. without incurring any additional expenditure. The Agricultural Department have done a great deal to help the ryots in this direction. Introduction of seeds from the Agricultural Research Stations has increased the yield of the land considerably. Ever since *Paramba navare* seeds found its way into this village more hill slopes have been brought into cultivation. More than seventy five tons of rice worth Rs 10,000, at least, is grown on *Kumari* lands of this village of Marnad when growing rice on hill slopes was unknown about a decade and a half ago. Green manure crop following rice plays an important part in enriching the soil and preventing erosion. Fruit culture which is still in its infancy will not only add to the income of the ryots but provide labour to the average villager, and result in the disappearance of many evils among the people when they learn to use their spare time profitably. There are still a number of crops and practices which will add to the material progress of this country, and help to fight against poverty and ignorance. Since space limits the mention of these another opportunity will be taken to explain them.

The Agricultural Department which is best fitted to help the villagers deserves the close co-operation of the educated public. A propaganda officer cannot, all of a sudden persuade a *ryot* to adopt improved methods of agriculture or use improved seeds, as he is held tightly within the dreadful jaws of ignorance. The *ryot* can, at the most imitate but not initiate. The approach of the villager through the few educated people is bound to crown the efforts of the Department with success.

Basel Mission Farm, Moodbidri, S. Kanara,

Yours etc.,
A. G. Soans.

Crop and Trade Reports.

Statistics—Crop—Groundnut—1941—Third Forecast Report. The average of the areas under groundnut in the Madras Province during the five years ending 1939-40 has represented 45·2 per cent. of the total area under groundnut in India. The area sown with groundnut up to 25th September 1941 is estimated at 2,076,500 acres. When compared with the area of 3,142,900 acres estimated for the corresponding period of the previous year, it reveals a decrease of 33·9 per cent. The decrease is general outside Malabar and is due mainly to the propaganda for the restriction of groundnut cultivation. The decrease in area is marked in Guntur (–95,000 acres), Kurnool (–218,000 acres), Bellary (–156,000 acres) and Anantapur (–89,000 acres) where the sowing rains also were in defect.

The summer crop throughout has been harvested. The yield was normal except in South Arcot, Chittoor, North Arcot and Tanjore where it was below normal on account of drought. The yield of the early crop was normal in Salem and Coimbatore. The condition of the main crop is reported to be satisfactory outside the Circars (Vizagapatam excepted), the Deccan and Chingleput where it was affected by drought to some extent. In parts of Bellary and South Arcot the crop suffered to some extent from attacks by insect pests.

The wholesale price of groundnut (machine shelled) per imperial maund of 82 2/7 lb. equivalent to 3,200 tolas) as reported from important market centres on 6th October 1941 was Rs. 4—12—0 in Vizagapatam and Guntur, Rs. 4—9—0 in Tadpatri, Rs. 4—8—0 in Vizianagram and Cuddalore, Rs. 4—2—0 in Vellore, Rs 4—1—0 in Cuddapah and Coimbatore, Rs. 4—0—0 in Nandyal, Rs. 3—14—0 in Hindupur, Rs. 3—12—0 in Salem, Rs. 3—10—0 in Bellary and Rs. 3—9—0 in Adoni and Guntakal. When compared with the prices published in the last report, i. e., those which prevailed on 4th August 1941, these prices reveal a rise of approximately 16 per cent. in Nandyal, three per cent. in Tadpatri and one per cent. in Vizagapatam and a fall of approximately 38 per cent. in Guntakal, 20 per cent. in Vellore, 17 per cent. in Adoni, 12 per cent. in Cuddapah, 11 per cent. in Bellary, 9 per cent. in Hindupur, 8 per cent. in Vizianagram and Cuddalore, 6 per cent. in Salem and 3 per cent. in Guntur.

(Director of Industries and Commerce, Madras).

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 3rd October 1941 amounted to 574,935 bales of 400 lb. lint as against an estimate of 503,500 bales of the total crop of 1940–41. The receipts in the corresponding period of the previous year were 447,473 bales. 506,452 bales mainly of pressed cotton were received at spinning mills and 59,387 bales were exported by sea while 95,980 bales were imported by sea mainly from Karachi and Bombay.

(Director of Agriculture, Madras).

Press Note.

Increase in Production of Rice and other Food Crops. In the Madras Presidency, though seventy-five per cent. of the area cropped is normally cultivated under food crops comprising paddy, millets and pulses, yet in 1939—40 rice was as usual, imported from Burma, Siam and Indo-China, to the tune of nearly 900,000 tons to support the population. For some months past, owing to inadequate shipping facilities, imports of rice are irregular and inadequate to meet the full requirements of the Province. Recently the war zone has extended nearer

to India and if the unsettled conditions in the East should develop, transport of rice across the seas from Burma, Siam, etc., might cease altogether.

2. Under these circumstances, every cultivator and landowner in the Presidency should remember the old adage, *Forewarned is forearmed* and bestir himself to increase the production of food crops from his holding to the utmost by intensive and extensive cultivation. In this great economic warfare of today, production of adequate food grains within the country is as important as the manufacture of arms and ammunitions. Food crops like paddy, ragi, cholam, cumbu korra, etc., could firstly be extended over larger areas by bringing new lands under the plough or replacing commercial crops like groundnut, tobacco, etc., that depend upon foreign countries for their disposal or adopting the practice of mixed cropping of suitable millets with the commercial crops; secondly, the acre yields of these crops, particularly under irrigation, can be increased by intensive methods of cultivation.

3. In this Presidency, there is not much unoccupied area for profitable cultivation under unirrigated conditions and in the case of irrigable lands, the extension of the area is limited by water supply from rivers and tanks. But certainly the area under commercial crops, like groundnut, tobacco and sugarcane now cultivated under irrigation can be appreciably reduced to make room for growing suitable grain crops. Commercial crops grown under rainfed conditions can also be sown mixed with suitable millets so that every acre of land is utilised to produce some quantity of food, however small it may be per acre, which on the aggregate will go to make up the deficit in imports.

4. For increasing the output of food crops in the areas now under cultivation, manuring especially for the irrigated crops is, so to say, the hand-maid of the cultivator and should be judiciously utilised to enhance his crop outturn per acre. In Madras about 10 million acres are devoted to food crops under irrigation and of this area, 8 million are occupied by paddy and the other two millions are cropped with ragi, cholam, cumbu, korra or tenai. It is in fact this irrigated area that contributes to make up the bulk of our home-grown staple food and if every acre of the irrigated land is adequately and systematically manured, there will be no room for any anxiety to meet the anticipated deficit in our food supplies. In the case of paddy lands, producing an average crop of 2,500 to 3,000 lb. per acre in the 1st crop season an increase of 10 to 20 per cent. is ordinarily obtained by manuring with 2 or 3 full cartloads of green leaf (4,000 to 6,000 lb.) or 400 to 500 lb. of oil cakes (groundnut, castor and neem cakes) costing about Rs. 10 per acre, while with the same rate of manures the lands now producing between 1,500 to 2,000 pounds, can be expected to yield an increase of 20—30 per cent. If green leaf is not available in sufficient quantities it may be supplemented proportionately with any of the oil cakes available cheaply in the locality. As a result of the war the price of oil cakes for want of export trade in oil seeds has come down to the economic limit and the expenditure on manuring will pay twice the outlay. Similar application of manure to the second crop paddy grown in the periods, September to January, or January to April, will enhance the yield by 30—50 per cent. over unmanured plots. Unfortunately, bulk of the area under paddy in the deltaic tracts is not normally manured. Lands close to villages and lands cultivated by the owner himself are regularly manured. On the whole, the proportion of regularly manured lands form a very insignificant part of the total area under the crop. If only every landlord and tenant cultivator come to a common understanding to share the expenditure amounting to Rs. 10 per acre on manuring they not only get back Rs. 20 worth of produce to share between themselves, but above all they will have contributed to convert their Rs. 10 investment into grain worth Rs. 20 which is so essential to sustain the population in this hour of need. Landlords, who know their tenants personally, can

invest or advance them the necessary money for manuring and get back the sum at harvest time. Banks are now offering credit at cheap interest and oil cakes are now cheaply available. Price of produce is also fairly high. This is an opportunity both for landlords and cultivators to profit themselves, while serving at the same time the larger interests of the country by producing more food.

5. The value of manure is further enhanced by cultivating high yielding strains that the Agricultural Department has been distributing. Unlike crops grown in rainfed areas yield of paddy grown under swamp conditions in puddle increases with the closeness of planting say 4" to 6" according to the duration of the crop and fertility of the soil. Kar and Kuruvai varieties are to be planted 4" apart while long duration Samba varieties may be planted 6" apart two seedlings per hole. The denser the crop grows, the higher is its final yield; because, the total yield from a unit area depends on the number of tillers produced in that area. The individual performance of plants planted wide though attractive, the final yield of the widely planted crop will be disappointing. If, for any local reason, wide planting is found necessary it is advisable to plant three or four seedlings per hole.

6. It is earnestly hoped that absentee landlords, tenant and land-owning cultivators of this Province will co-operate with one another and seriously consider the problem of increasing the production of food crops, paddy, cholam ragi, cumbu, korra, etc.. in the land they cultivate or own by adopting one or other of the five following recommendations.

1. Wherever possible, consider the replacement or reduction in the area under commercial crops with suitable food crops, paddy or millets;
2. Sow millets as a mixture with commercial crops that cannot be wholly replaced in rainfed and garden land area;
3. Manure every acre of crop cultivated with the aid of irrigation;
4. Seek high yielding strains that the Department is advocating in the area;
5. Adopt close planting of paddy when grown under wet puddle condition.

Director of Agriculture, Madras.

College and Estate News.

Students' Corner. *Tour.* The final year students of the college were out on an agricultural study tour from the 2nd to the 15th October visiting the following places:—

Guntur. The Agricultural and Livestock Research Station, Lam, the tobacco market yard, the Majetty Tobacco factory and the village of Angalakudum, where they were entertained at dinner by the Commissioner of the Guntur Municipality.

Nellore. Rice Research sub-station, Buchireddipalem, Kanigiri Reservoir and Rice grading centre.

Koduru. The Fruit Station, neighbouring nurseries, orchards, fruit growers association and grading of oranges.

Katpadi. The American Arcot Mission Farm where poultry breeding is done on a large scale.

Gudiyattam. The sugarcane research station.

Bangalore. The Imperial Dairy Institute, Hebbal Farm, Horticultural Gardens, Serum Institute and Indian Institute of Science.

The district officers of the Department in the respective places and those in Bangalore made all possible arrangements to make the tour as instructive and comfortable as possible. The party were accompanied by Sri. K. Raghavachari, Junior Lecturer in Agriculture and Sri. S. V. Duraiswami, Teaching Assistant.

Cricket. The first match of the Rhondy Shield Cricket tournament was played on the 26th August between our College eleven and the Government College, Coimbatore. Our College scored 79 runs while the visitors scored 96 runs and thus won the match. The second match of the tournament was played on the 18th October between our College and the Victoria College, Palghat. The visitors won the match by scoring 127 runs against 54 scored by us.

University Extension Lectures. Under the auspices of the University of Madras, Mr. J. J. De Valois, B. Sc., Principal, A. A. M. Agricultural Institute, Katpadi delivered two interesting and instructive lectures on the 17th and 18th October on "Livestock and India's Economic Development" and "God's greatest gift, the Soil—production and care". Mr. R. C. Broadfoot, Principal and Gulam Dastigar Sahib Bahadur, the District Educational Officer, Coimbatore, presided over the meetings, on the first and second day respectively. Both the meetings were well attended.

The Refresher Course. The officers that attended the refresher course were taken by the Research Engineer to the Radio Institute of Mr. G. D. Naidu; he gave them tea and showed them round and explained the interesting work that is being carried on there. They were entertained at tea by the Heads of Sections at the College on the 13th. The course was completed on the 15th and most of the officers left the estate the same evening. During their stay here the Managing Committee of the Union approached and enlisted many 'old boys' as members of the Union. It is hoped that similar response will be forthcoming from other 'old boys' who are not members of the Union at present.

M. Sc. Degree. We are very glad to note that the University of Madras, has awarded the degree of M. Sc. on Sri. T. N. Ananthanarayanan, B. Sc., Ag., Assistant in Chemistry, Imperial Sugarcane Station, for his thesis on "The origin and geo-chemistry of the soils of Madras—Deccan", and on Sri G. Seshadri Ayyangar, M. A., Assistant, Cotton Section, for his thesis on "The origin of lint and fuzz in cotton". We offer our hearty congratulations to them.

Scouting. An ordinary meeting of the Group Committee of the Ramakrishna Scout Group was held on 17th September 1941. The report of the Secretary presented at the meeting indicated that about 10 gentlemen of the staff of the Agricultural College and Research Institute had just completed their scoutmasters' training and were ready to take up troop work on the College Estate. The strength of the Scout Group on the date of the meeting consisted of 37 scouts, 27 cubs and 6 rovers. A sum of over Rs. 60 had been promised as donation by the Estate residents of which about half had already been realised on that date. A set of By-Laws were also adopted by the Committee, and the accounts were scrutinised and certain items of expenditure were sanctioned.

Visitors. Mr. H. M. Hood, Second Adviser to H. E. the Governor of Madras and Mr. P. H. Rama Reddy, the Director of Agriculture, visited the Agricultural College and Research Institute, during the month.

RETIREMENT

RAO BAHADUR Y. RAMACHANDRA RAO

Rao Bahadur Y. Ramachandra Rao, Locust Entomologist, Imperial Council of Agricultural Research, and formerly Entomologist to the Government of Madras, retires from Service this month.

Yelseti Ramachandra Rao was born in a respectable Brahmin family in the village of Yelseti in the Bellary District on the 11th September 1885. His early days were, however, spent in the Tamil districts of Tinnevelly and

Rao Bahadur
Yelseti Ramachandra Rao, M.A., F.Z.S.

Madura, where he had his school education. In 1900, while still a lad of fifteen, he left for Madras to join the Madras Christian College for his University education. He graduated in 1904 with distinction, and at this stage, making up his mind to pursue a scientific career, enrolled himself as a post graduate student in Zoology under Dr. Henderson. He took his M. A. Degree in 1906, and entered Government service the same year, as Assistant in Entomology, in the Madras Agricultural Department. After a period of training under Prof. Lefroy at Pusa for six months, Mr. Rao applied himself to the work before him and impressed his superiors with his earnestness, enthusiasm, keenness and painstaking diligence. A stickler for thoroughness he never did anything slip shod.

In 1916, the Government of India entrusted him with the task of making a survey of the insect enemies of Lantana, with a view to utilizing them for its control. This work which was extremely arduous by its nature entailing, as it did, a considerable amount of physical hardship, gave Mr. Rao opportunities to prove his worth as a first class field investigator, besides enabling him to enrich his experience of the insect world. The results of his enquiry were published as a memoir of the Imperial Agricultural Department, and in recognition of Mr. R. Rao's services the title of Rao Sahib was bestowed on him.

Mr. Ramachandra Rao was appointed as Assistant Entomologist in Iraq, in 1919, where he did a great deal of pioneer work on the insect pests of the date palm and other crop plants in Iraq.

He returned to India in 1921, and he was promoted to the Madras Agricultural Service, as Economic Assistant to the Government Entomologist in 1922.

When Mr. Ballard left India, Mr. Rao was appointed as Government Entomologist, which post he filled with rare distinction till 1930 when foreign service again took him away from Madras.

As Government Entomologist, Mr. Rao, had to shoulder heavy responsibilities. This period of Mr. Rao's career was characterised by the same enthusiasm, diligence and perseverance and strict regard for accuracy which he showed in his earlier years.

From December 1930, till the period of his retirement he was under the service of the Imperial Council of Agricultural Research, as Deputy Locust Research Entomologist at Quetta. In this capacity he attended the Third International Locust Conference in London as a delegate from the Government of India. The results of his labours on Locust work, have been written up and are awaiting publication. As an Entomologist in Madras he devoted his attention chiefly towards the economic side of the subject and among the more important items, the following are to his credit: (1) The trial of biological control of the coconut caterpillar pest. (Nephantis serinopa) with the aid of parasites. (2) The introduction of Vedalia beetles to check the wattle scale (3) the control of Mango hopper (4) the control of the Red

hairy caterpillar with the aid of legislation (5) the control of the Paddy army worm. Besides these he interested himself in the study of the pests of cotton and sugarcane. In reviewing his work, as an Entomologist, one must remember that Mr. Rao avoided the merely spectacular, and concentrated his attention on securing successful results in the field, with the result that his published work does not adequately represent his actual acheivements. Himself a model of thorough-going efficiency, always hard-working and conscientious in the discharge of his duties he did not tolerate in his subordinates perfunctory or slovenly work. But extremely affable and endowed with the true spirit of science, Mr. Rao ruled his subordinates, with kindness rather than severity, by example rather than precept, that he was more loved and respected than feared.

Mr. Rao was deeply attached to the Madras Agricultural Journal and he was one of those who were mainly responsible for its secure foundation laid in the early years of its existence. He was the Editor of the Journal for three successive years, (1922—1924) and continued to be a member of Editorial Board till he left Coimbatore. He was also Secretary of the Officers' Club for two successive years. In the discharge of his work in these honorary capacities he exhibited the same zeal for thoroughness and efficiency as in his official work.

It is a great pity in the closing days of his official career an unfortunate domestic bereavement in the death of his promising young son deprived Mr. Rao of that peace of mind and happiness which are his due after years of strenuous and active life.

May God give him strength to bear the blow with fortitude and enable him to pass the rest of his days with equanimity and peace of mind.

K. UNNIKRISHNA MENON

Sri. K. Unnikrishna Menon is a distinguished Diplomate of the Saidapet Agricultural College. He was recruited to the subordinate service of the Madras Agricultural Department in May 1908. He worked in various capacities in different districts of the Presidency. He served as Demonstrator in Malabar, Farm Manager at the Taliparamba and Palur Farms, and after a period of training at the Teachers' College, Saidapet, as a Teaching Assistant at the Agricultural College, Coimbatore. He was promoted to the Madras Agricultural service as Assistant Director of Agriculture, Madura, in June 1922. After serving as District Officer in Tellicherry and St. Thomas Mount, and as Assistant Superintendent, Central Farm, Coimbatore he was promoted as Deputy Director of Agriculture in 1933. He was Deputy Director at St. Thomas Mount, Bellary, Madura, Tellicherry and Coimbatore. For a short period he was Head quarters Deputy Director of Agriculture at Madras. He was finally appointed as Senior Lecturer in Agriculture and Superintendent, Central Farm, Agricultural College and Research Institute, Coimbatore, in August 1940. He availed of leave in May 1941, preparatory to retirement, and retired from service in September 1941.

As a District Officer and Circle Officer he took keen interest in co-operative organisations and rural development. He was a hardworking, conscientious and sympathetic officer, and was generous minded to often overlook the faults and shortcomings of his subordinates. He is of a religious turn of mind.

He is one of the oldest members of the Madras Agricultural Students' Union and, whenever he happened to be stationed at Coimbatore, he took a keen interest in the affairs of the Union. He has helped the Union in various capacities in its management. He was the Vice-President of the Union during the year 1938—39.

We wish him a long and happy life in his retirement.

Weather Review—SEPTEMBER 1941.

RAINFALL DATA

Division	Station.	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	6·2	−1·3	24·0
	Calingapatam	10·6	+3·2	24·2
	Vizagapatam	5·1	−1·4	21·3
	Anakapalli*	5·6	−2·2	22·9
	Samalkota*	8·4	+1·3	30·4
	Maruteru*	5·0	−1·0	24·6
	Cocanada	3·3	−2·5	38·6
	Masulipatam	4·7	−1·5	17·4
	Guntur*	5·3	−0·8	13·9
Ceded Dists.	Kurnool	7·5	+1·3	12·4
	Nandyal*	8·4	+1·7	16·6
	Hagari*	6·5	+1·7	12·5
	Siruguppa*	7·3	+0·9	18·9
	Cuddapah	8·3	+2·0	19·3
	Bellary	6·7	+1·6	19·1
	Anantapur	7·7	+0·4	15·0
	Rentachintala	5·8		16·6
	Anantharajupet*	7·9	0·0	0·0
Carnatic	Nellore	3·9	−0·9	10·1
	Madras	7·6	+2·6	15·5
	Palur*	9·6	+5·4	21·5
	Tindivanam*	8·3	+3·7	15·1
	Cuddalore	7·5	+1·4	21·5
Central	Vellore	10·0	+2·7	16·7
	Gudiyattam*	5·7	−0·5	14·5
	Salem	8·2	+1·6	25·2
	Coimbatore	4·2	+2·7	18·9
	Coimbatore A. C. & R. I.*	2·6	+0·8	19·3
	Trichinopoly	4·5	−0·3	11·1
South	Negapatam	4·4	+0·6	10·9
	Aduthurai*	7·1	+4·0	14·6
	Madura	3·0	−2·1	20·1
	Pamban	0·5	−0·7	9·4
	Koilpatti*	4·5	+2·3	10·8
	Palamkottah	2·6	+1·3	10·1
West Coast	Trivandrum	11·1	0·0	65·2
	Cochin	13·4	+4·4	100·4
	Calicut	8·1	+0·4	112·7
	Pattambi*	4·2	−3·3	109·0
	Taliparamba*	9·0	+0·6	98·3
	Kasargode*	7·3	−1·7	94·5
	Nileshwar*	7·8	−1·1	98·2
	Mangalore	11·1	+0·7	85·7
Mysore and Coorg	Chitaldrug	4·9	+0·4	15·8
	Bangalore	5·2	−1·8	22·5
	Mysore	7·0	+2·8	31·4
	Mercara	9·6	−1·2	117·2
Hills	Kodaikanal	8·3	+1·0	34·4
	Coonoor			
	Ootacamund*	4·1	+0·5	32·6
	Nanjanad*	4·7	0·0	43·4

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated up to 1937 (published in Fort St. George Gazette).

Rainfall was widespread in the peninsula till about the 5th of the month, and was associated with thunderstorms. On the 6th conditions became unsettled in the north and central Bay of Bengal with the passage of a low pressure wave across Burma from the East, and developed into a depression in the North-West angle of the Bay on the next day. This depression crossed the Coast near Balasore on the 8th and moving across the Central Provinces disappeared over Central India by the 10th. On the same day conditions were again disturbed in the North Andaman sea, which extended into the Central Bay of Bengal on the 11th, and concentrated into a depression centred at about 15°N and 84°E on the 12th and crossed the Coast and by the 14th morning lay as a diffused area of low pressure over Central Deccan. It persisted over the central parts of the peninsula till it disappeared over Bihar on the 21st. During the formation and passage of this disturbance, widespread rain occured nearly all over the peninsula. The monsoon began withdrawing from Upper India about the 20th and had completely withdrawn from North-East India by the end of the month, and conditions became favourable for setting in of the North East Monsoon rains in the Madras Presidency. Rainfall during the month was well distributed over the presidency, and was generally above normal.

The chief falls recorded being:

Peermede (Travancore).	6·5″	(18th).
Kottayam (do.)	6·2″	(23rd).
Calingapatam	5·8″	(16th).
Anantapur	4·1″	(19th).
Hagari	3·9″	(23rd).
Cochin	3·8″	(18th).
Nandyal	3·3″	
Madras	3·1″	(1st)

Weather Report for the Agricultural College & Research Institute Observatory

Report No. 9/41.

Absolute maximum in shade.	...	91·8°F
Absolute minimum in shade.	...	69·5°F
Mean maximum in shade	...	88 5°F
Departure from normal.	...	−1 0°F
Mean minimum in shade.	...	71·8°F
Departure from normal.	...	+1·3°F
Total rainfall for the month.	...	2·58″
Departure from normal.	...	+0 79″
Heaviest fall in 24 hours	...	0·98″
Total number of rainy days.	...	6
Mean daily wind velocity.	...	2·2 M. P. H.
Departure from normal.	...	−3·0 M. P. H.
Mean humidity at 8 hours.	...	78·0 %
Departure from normal.	...	4·5 %

Summary: (For Coimbatore report).

The weather during the month was generally unsettled as is characteristic of the transition period, with thunderstorm activity during the first two weeks and again towards the end of the month. Rainfall was associated with thunderstorms, and totalled 2·58″ or 0·79″ in excess of normal. Day temperatures were below normal while night temperatures were above normal. Skies were in general heavily clouded and humidity in excess of normal. Wind movement was much weaker than normal.

P. V. R. & S. V. K.

Departmental Notifications.

Gazetted Service.

Postings.

Sri. K. Jagannatha Rao, Upper Subordinate, IV Grade, to act as District Agricultural Officer, Guntur, in Category 5 of Class I of the Madras Agricultural Service.

Sri. N. Subramania Ayyar, Officiating District Agricultural Officer on relief by Sri. K. Avudainayakam Pillai to officiate as District Agricultural Officer, Coimbatore, in relief of Sri. M. U. Vellodi.

Sri. V. K. Subramanya Mudaliyar, temporary Gazetted Assistant, Mungari Cotton Scheme, Adoni, on return from leave is posted to the same post.

Sri. K. Avudainayakam Pillai, Officiating District Agricultural Officer, on return from leave to officiate as District Agricultural Officer, Ramnad, Sattur.

Leave.

Sri. M. U. Vellodi, D. A. O., Coimbatore, l. a. p. for 1½ months from the date of relief.

Subordinate Service.

Appointments.

The following appointments of Upper Subordinates, Agricultural Section, III grade (new) are ordered :—

Sri. R. Soundararajan—Farm Manager, Central Farm, Coimbatore.
,, M. Atchanna Sastri—Farm Manager, Agricultural Research Station, Maruteru.
,, K. Dorairaj—Farm Manager, Agricultural Research Station, Siruguppa.

Transfers.

Name of officers	From	To
Sri. S. M. Kalyanarama Ayyar.	Asst. in charge Mungari Cotton Scheme, Adoni,	Asst. in Cotton, Cotton Breeding station, Coimbatore.
,, V. K. Kunhunni Nambiar,	F. M. A. R. S. Pattambi,	A. D., Udumalpet.
,, K. Govinda Kurup,	F. M., Central Farm, Coimbatore,	F. M. A. R. S., Pattambi.
,, K. Rangaswami Ayyangar,	F. M. A. R. S., Maruteru,	A. D., Sulurpet.
,, S. Muthuswami Gounden,	F. M. A, R. S., Siruguppa,	A. D., Srivilliputhur.
,, K. Dorai Raj,	A. R. S., Pattambi,	F. M. A. R. S., Siruguppa.
,, A. Venkatarangam,	A. D., Rapur,	A. D., Venkatagiri.
,, K. Meenakshisundaram,	F. M. D. F, S., Hagari,	A. D., Ambasamudram.
,, T. Ramanujulu Naidu,	A. D., Bhadrachalam,	Nuguru Agency.
,, V. Buchi Raju.	A. D., Nuguru,	A. D., Bhadrachalam.
,, P. S. Venkata-subrahmanyam,	F. M. A. R. S., Tindivanam,	A. D., Nellore.
,, R. Kolandavelu Naicker,	A. D., Peravurani,	F. M. A. R. S., Tindivanam.
,, M. J. David,	Asst. in Soil Physics, D.F.S. Hagari (on leave),	A. D., Tanjore District.
,, V. Achyutam Pantulu,	A. A. D., Rajahmundry,	A. D., Tiruvur.
,, Rangabrahma Rao Naidu,	A. D., Tiruvur,	A. D., Rajahmundry.

Leave.

Name of officers.	Period of leave.
Sri. R. Venkatarama Ayyar, Foreign service under the Groundnut Market Committee, Cuddalore,	L. a. p. for 2 months from 2—9—41.
„ D. Bapayya, Foreign service under the Tobacco Market Committee, Guntur.	Extension of L. a. p. for 3 months from 13—9—41.
„ V. Chidambaram Pillai, A. D. Sankarankoil,	Further extension of L. a. p. for 3 weeks.
„ M. Narasimham, A. D., Tenali,	Extension of L. a. p. for 1 month from 8—10—41.
„ V. Achyutam Pantulu, A. A. D., Rajahmundry,	L. a. p. on m. c. for 3 months from the date of relief.
„ V. Venkatadri Reddi, F. M., (on leave),	Leave on half average pay on m. c. for 6 months from 18—9—41.
„ R. Kolandavelu Naicker, A. D., Peravurni,	L. a. p. for 2 months from the date of relief.
„ N. C. Tirumalachari, A. D., Srivilliputhur,	L. a. p. for 1 month and 23 days from 1—11—41.
„ N. Ramadoss, A. D., Ongole.	Extension of L. a. p. for 1 month from 10—10—41.
„ Krishna Hegde, F. M. A. R. S., Nanjanad,	Extension of L. a. p. for 1 month from 18—10—41.
„ A. Venkatachari, A. A. D., Harpanahalli,	Extension of L. a. p. for 12 days and half average pay for 18 days from 5—10—41,

Agricultural College and Research Institute, Coimbatore.

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1. *Rothamsted Field Experiments on the Growth of Wheat*, Russel E. J. & Watson, D. J. (1940). 2. *Field Trials—Their Layout and Statistical Analysis*, Wishart, J. (1940). 3. *The Mineral Composition of Crops with Particular reference to the Soils*, Beeson, K. C. (1941). 4. *Preliminary Survey of Some of the Soils in Kenya*, Gracie, D. S. (1930). 5. *Vegetable Propogation of Tropical and Sub-Tropical Plantation Crops*, Fieldman, C. S. C. and Gamer, R. J. (1940). 6. *Plant Hormones and Their Practical Importance in Horticulture*, Pears, H. L. (1939). 7. *Fruit Juices and Related Products*, Charley, V. L. S. and Harrison, T. B. J. (1939). 8. *Preservation of Fruit Products, (in Telugu)*, Jogi Raju, G. (1941). 9. *Pandlu—Part 3—Orange Family, (in Telugu)* Jogi Raju, G. (1941). 10. *Fruit Culture*, Jogi Raju, G. (1941). 11, *Vegetable Gardening in Malaya*, Milsum, J. M. and Grist, J. D. (1941). 12. *Fruit Pectins—Their Chemical Behaviour and Jellying Properties*, Hinton, C. L. (1939). 13. *Nitrogen Supply to Tea*, Cooper, H. R. (1939). 14. *Grassland Investigations in Australia* (*Herbage Bulletin No. 29*). (Contributions). (1940). 15. *The Control of Weeds*, White, P. O. (Editor). (1940). 16. *Farm Productions and Prices in the U. S. A. 1869-1937*, Stanes, F. & Bean, L. H. (1940). 17. *The Land Grant*

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1. Annual Administration Report of the Tea Scientific Department for 1940—41 (S. India). 2. 15th Annual Report of the Lalgudi Sivagnanam Co-operative Agricultural Society 1936—37 to 1939—40. 3. South India Coffee Scientific Officer, Annual Report for 1940. 4. Annual Report, Travancore Agricultural Department, 1939—40. 5. Mysore Government Gardens Annual Report 1939—40. 6. Report of the Agricultural College, Nagpur for 1939—40. 7. 11th Annual Report of the Executive Council of the Engineering Imperial Agricultural Bureau 1939—40. 8. Cylon Coconut Research Scheme Annual Report. 1940.

Proceedings, Reviews, etc.

1. Biochemical and Allied Research in India, Annual Review 1940. 2. Pro. 21st. Meeting of the I. C. A. R. New Delhi. 3 Fourth Oxford Farming Conference 1939. 4. Pro. Assn. of Land Grant Colleges and Universities (U. S. A.) 54th 5. Pro. Amer. Soc. Hort. Sci. 1940.

The Madras Agricultural Journal.

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EDITORIAL

Indian Cattle. That India has been predominantly an agricultural country and that her wealth ever lay in her crops and cattle are facts which no one can deny. It is but fit that the Advisory Board of the Imperial Council of Agricultural Research should have thought over the cattle problem and recommended that steps should be taken to encourage the export of Indian cattle which would have a very encouraging effect on cattle breeding. In fact, this was the view that was held by the Royal Commission on Agriculture when they declared, "It is certain that no other circumstances would more favour private enterprise in breeding in India than the existence of an export market for high class stock." It is indeed very gratifying to note that during the last thirty or forty years several batches of Indian cattle have been exported to other countries, and that in various parts of the world, particularly South America, cross breeding with the Zebu (a type best suited for cross breeding with the European) has become the established practice. It is learnt that there are breeders who keep herds of pure Indian cattle for the production and sale of pure-bred stud bulls. It is the curious irony of fate that for Indian cattle foreign markets have to be sought. But this fact is an eyeopener, and already the Advisory Board of the Imperial Council of Agricultural Research have moved in the matter in the right direction. From information gathered, it is clear that the Ongole cattle was exported from Madras to Brazil, and that to-day the progeny of this breed is splendidly thriving in that land. Not only Ongole, but other valuable breeds like the Gir, the Kankraj and the Sahiwal are all said to be coming up very well in foreign lands. The realization of the value of Zebu blood in other tropical countries of the world has raised the importance of Indian cattle in the eyes of the world. Considered and expert opinion is in favour of export of Indian cattle. Coupled with an organization for the development of production of pedigree cattle, the future of Indian cattle is sure to be very bright. And as the Editor, *Indian Farming* has written—'With the help of breed societies and an efficient Herd Book organization with its system of registration of all pure-bred animals, it should be possible to develop and control the export trade in the interest of both the breed and the breeder.

Vegetable Drugs. A number of drugs, including some of vital importance, were being imported from the Continent, and with the outbreak of war and occupation by the enemy of various European countries, the Empire supplies are cut off. In this interruption of drug supplies we have

a serious problem to deal with. It is well known that a number of drugs are procurable in India. It is therefore urged that the collection of these from wild sources and the production of these by cultivation be encouraged. In this connection the readers of the Madras Agricultural Journal are referred to the very comprehensive and valuable memorandum prepared by M. Ashby, on "War-time Drug Supplies and Empire Production" published in the *Bulletin of the Imperial Institute,* Vol. 39, 1941, No. 1. It is mentioned that a sub-committee has been set up to act as a clearing centre for information and advice. This Committee is expected to deal with all inquiries, promote experimental work and initiate action where necessary.

While it is not possible to bring together all the valuable drugs that are available in this country, in the space of an editorial, mention will be made of the more important amongst them, with the fervent hope that this will stimulate those interested in the line to pursue the subject in detail and render all help to the Empire in its hour of need.—*Digitalis purpurea* L., the Foxglove, in the Nilgiris; *Datura stramonium* L., thorn apple, in the Hills; *Cinchona succirubra,* (Pavon ox Klotzech,) *C. officinalis* Hk. etc.; *Peucedanum graveolens* Benth, the dill, throughout India, commonly used by Ayurvedic doctors also and known as *sathakuppai* in Tamil; *Valeriana officinalis* L., the valerian in the Himalayas; *Pimpinella anisum,* the anise (Tam: *Sombu*) common in parts of India; *Cephaelis Ipecacuanha* Rich the ipecac, in the Nilgiris; *Terminalia Arjuna* W. & A., from which tincture arjun is prepared; all over the Province; *Zingiber officinale* Rosc., the ginger, all over India; *Acorus Calamus* Linn;, the sweet flag, in swamps in Nilgiris and Malabar: *Elettaria Cardamomum* Maton, the Cardamom, in Mysore and West Coast.

Indian Census. In a very well thought out article on "The census as an agency for economic planning", (*Sankhya,* Vol. 5, Part 3), Professor P. J. Thomas has pointed out the defects in the present system of taking census especially in the matter of classifying earner or dependant. To quote his own words; "Especially in agricultural communities, not only the principal earner but other members of the family, women and even children, assist in his work and therefore this further classification was justified. Although this change may be good for the future, it has made comparison of previous censuses difficult. As Dr. Hutton says, the 'earners' plus 'working dependants' of 1931 are perhaps equivalent to the 'workers' of 1921. But various misunderstandings and mis-entries have occurred and the figures do not enable us to study the occupational trends correctly." He has rightly deplored the dropping out of industrial census since 1931 and emphasized on the need for the Economic Departments of the Universities to render help in this work and pile up valuable information on the economic condition of our urban areas with the help of census schedules and supplementary questionnaires. It is urged that in view of the fact our country is now keen on economic planning for which accurate economic data is necessary, a permanent staff be maintained by the Government of India for working up the material collected at each census.

Rose Growing.

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The rose is no foreigner to India. Many species of roses grow wild in the Himalayas. History reveals that as far back as the Seventeenth Century the Empress Nur Jehan was acquainted with the process of preparing the Otto of the rose. *Attar, Pannir* and *Gulkhand* or rose-petal preserve are some of the other preparations known in this country from the Eighteenth Century onwards. A famous authority on roses is of opinion that the queen of flowers was introduced from India and Persia to the Greek and Roman Empires. There is no flower to excel the rose in beauty, fragrance and variety and the rose plant is one that gives flowers throughout the year.

Rose culture is a very interesting study. There are innumerable varieties of roses differing in colour, size, shape and fragrance. It is estimated that there are not less than two thousand totally different varieties. However, that need not dishearten the amateur gardener who is eager to have a few varieties of roses in his garden. It is also better to have a selected few instead of speculating with a considerably large number of varieties.

Roses may be grown in beds and in pots. Many people doubt whether good rose plants can be successfully grown in beds. They believe that roses are such tender plants which need special attention that can be given only when they are in pots. The doubts are entirely groundless because rose growing is literally an industry in many villages in South India. There are many commercial growers who send a regular supply of roses to the important markets all through the year.

For successful rose growing the most important point is the selection of the site. The ideal location is an open elevated and airy plot entirely free from shade. The rose plants need plenty of sunlight and it is essential therefore that an ideal rose plot should be free from the shade of overhanging trees. Even the shade of adjoining buildings should be avoided. There should be absolutely no interference from the roots of trees that may grow anywhere nearby. These voracious roots will impoverish the rose beds. The roots of such trees, if there are any, can be successfully kept off by digging trenches about three feet wide and cutting the roots to the level of the deepest roots of the rose beds. Another method of preventing the roots is inserting old galvanised iron sheets between the roots and the rose beds. Where there are lawns rose beds can be had with different outlines cut out in the lawns. In limited space it is better to make the beds as simple and uniform as possible.

Preparation of beds. An ideal rose soil should be preferably a rich sandy loam. In places where there is likely to be scanty rainfall the soil

can be heavy loam and in places with heavy rainfall porous soils are essential. In spacious compounds a central place in the foreground of the building can be selected for having roses.

Dimensions. The beds can be as long as possible and convenient. But the width should not be more than five feet. If the beds are wider, the soil round the plants will often be trodden upon while working amongst them and plucking flowers. Hence the beds should be only so wide as to enable one to reach the centre of the beds from the sides. The depth of the beds should not be less than three feet. But the greater the depth the better the result. As good drainage is essential it is advisable to have a layer of four to six inches of broken tiles and bricks at the bottom.

It is advantageous to have the pits dug ready at least a month before planting. The soil removed from the pit can be thrown up on the sides. This will enable the soil to have good aeration and nitrification.

When the soil is well aerated and pulverized it should be mixed with well rotten cattle manure at the rate of about a cartload for 100 sq. feet of bed. But before filling the beds with this mixture it is good to have a thin layer of broken bones in the lower portion of the beds. This will last long and will be ready for the plants when they begin to bloom.

Planting. Except in places where there are extremes of climate roses can be planted during most part of the year. But the best time is during the beginning of the rains. The plants establish root growth during the rains. But care should be taken against water logging. The proper time for planting is the later half of the afternoon. The plants should be protected from the hot sun for the next two or three days. This can effectively be done by shading with a thatch of palmyra or coconut leaves. The different varieties should be planted in separate beds. There is no hard and fast rule as regards spacing. A mass of plants look better than a solitary plant. But very close planting should also be avoided. The moderate spacing is about 18 to 24 inches all round. The plants should not be deeply planted in the case of "Budded" or "Grafted" roses, the point of union should be not more than 3" below the ground level.

Watering. Watering once in four days is all that is needed for the next few days till the plants are established well. One good watering is sufficient for about a week from the time the plants are established well. Copious watering is good for roses but waterlogging should be avoided. However, in the flowering season flooding the beds oftener will do good.

Manuring. The beds do not require any addition of manure during the first year. The initial mixture contains enough manure to induce the first year's growth. Once roses are established and growing they may be fed regularly with advantage. As is the general truth, over manuring is injurious to roses also. Organic manures are always preferable to chemical manures in the case of roses. Chemicals have to be properly mixed and applied. There is also the risk of overdosing. The chemicals are injurious

in that they make the soil sour very soon. Cattle manure is the best manure for roses. Horse manure and pig dung come next. Experiments have proved that roses respond very well to a mixture of horse manure and cattle manure in equal proportions. But it is essential in these cases that they should be well rotten.

Well rotten manure will be dark brown in colour and can be powdered easily by the hand. The manure should be powdered well and passed through a sieve before using. Leaf mould is another useful manure. Though it is not chemically very rich, the manure can improve both heavy and light soils. Bone meal and fish meal are also useful, though these are very slow in their action. Oil cakes are not absolute necessities. However a small dose of castor cake in powdery and rotten condition applied after the rains forces the plant to flower profusely.

Extra vigorous growth and quick flowering can be brought about very successfully with liquid manures. The gardener who has to meet an urgent demand for roses and the amateur who has to get ready roses for exhibitions should remember this. The clever grower is alive to the fact that the use of liquid manure in a dilute state affords a safe, efficient and rapidly acting means of nourishing the plants and promoting growth. It is made by immersing a quantity of solid manure in a tank or tub of water until its soluble contents are diffused through the whole volume of water. It is impossible to stipulate the precise proportions of liquid manure and water that should be mixed up for safety and serviceability. But the safe rule is to use a liquid manure so weak that a sufficient quantity may be given to thoroughly soak the area of root spread without the risk of injuring the most fragile root hair. "Weak and often" is the secret in the case of liquid manures.

After the addition of manures the plants should not be immediately watered unless manures have been added in excessive quantities in which case they will be injurious to the plants. The top layer of soil in the beds should be well worked with hoes or hand forks, as to make the soil mellow and friable. Watering should then be done. But flooding should be avoided now. Good irrigation can be given only when the buds appear in the shoots. Watering can be more profusely given thereafter.

Pruning. It is essential that we have a control over the growth of the rose plants as otherwise old exhausted shoots, if allowed to remain, will take away much of the food material and will be a drain on the resources of the plant. If the plants are likely to grow mis-shapen, then also pruning can be successfully resorted to. Pruning is a special necessity if flowers are required on a particular date. In this case pruning should be done at least two months before the time.

When to prune. A plant should never be pruned until it is well established, which will not be before at least a year is over. The local climatic condition should also be taken into consideration. Pruning should

not be done during the hot summer months or just before the rainy months. For in the latter case, the plants may put forth profuse leafy growth and few flowers. Hence the correct time for pruning is the period when the plants are dormant and when they begin to shed some of their leaves after the rains. As far as enquiries and practical experience go, the proper time for pruning seems to be middle of October.

How to prune. A sharp secateur is essential for pruning. The unwanted old and dead shoots should be first cut clean off from the seat of their growth. Crossed shoots must then be removed. Too many shoots should not be left in the plants. Strong single shoots growing from the base should be pruned back to about 18 inches from the ground and two to three buds should be left on the laterals which have grown from the main shoot. In leaving the buds it is necessary to see that buds pointing outwards are left in the shoots and not those which point inwards. This is necessary because the central region of the plant will get crowded very soon if the inward pointing buds begin to grow. The particulars given so far do not exhaust the subject of pruning. It is a separate technique by itself and there are countless varieties of roses and various types of growth—which require individual consideration. But discretion and common sense must always be used. More information can be obtained from the book on *Pruning Roses* published by the National Rose Society of England.

Pests and diseases. Pests. (i) Caterpillars. These eat away the tender shoots at night. Hand picking of the caterpillars can be done if found in small numbers. But if there are too many of them a strong solution of lead arsenate, 1 lb. of powder in 25 gallons of water, can be sprayed at intervals over the plants.

(ii) Aphids or plant lice. These feed on the growing points and flower buds. A wash with a contact insecticide, like tobacco decoction, will control the pest.

(iii) Rose beetles and cockchafers. These also damage the leaves and the young ones of these beetles damage the roots as well. Naphthalene powder can be sprayed at the bottom of the plants to kill the larvae. kerosene emulsion (Bar soap 8 oz., water 1 gal., kerosene 2 gal.) or lead arsenate has to be sprayed to kill the adults.

(iv) White ants are sometimes the worst enemies of the rose plants. especially in young cuttings. They are worst because if once they attack the roots of the plants it is rather difficult to save the plants. Plants which are apparently healthy, suddenly wither and droop down. Transplanting in a fresh pit can be tried. Irrigation water mixed with crude oil emulsion will also be effective.

Diseases. There are several fungus diseases, of which, rust, mildew and black-spot are important. Sudden changes in the temperature and atmospheric conditions are supposed to be very favourable to these diseases.

These attack the leaves, the leaf-stalks and stems. Greyish or brownish black spots appear among the affected area and the leaves begin to fall away quickly. Once the disease is detected, it is wise to remove the affected portions from the plant and burn them. On the other hand if they are not removed the fungus will soon spread to other healthier parts of the plant.

The general and effective remedy in the case of fungus attack is spraying with Bordeaux mixture. This mixture is a notable fungicide. It is prepared with a pound each of copper sulphate and quick lime mixed up in ten gallons of water. Copper sulphate and lime are separately dissolved in water in mud pots and both mixed in a third pot and diluted to the aforesaid strength. This mixture should be used as soon as it is made. The local Agricultural Demonstrator will be able to render further help needed in the matter of preparation or application of this fungicide.

Culture of Oranges at Kodur.*

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In popular parlance the word orange designates both the tight jacket or sweet oranges and the loose jacket or mandarines. The application of the name orange to both the sweet oranges and the loose jackets is very misleading and has been responsible for a lot of confusion with the fruit-nursery and growing industries. There is, however, some doubt whether our loose jacket orange is really a mandarine, as some authorities have put it to be identical with the famous *Ponkan* orange of China—*Citrus poonensis,* Tanaka, while the mandarine is botanically known as *Citrus tangerina,* Tanaka or *Citrus nobilis var. deliciosa,* Swingle. There is no such doubt, however, about the nomenclature of sweet oranges (*Citrus sinensis,* Osbeck) under which fall our Sathgudi, Batavian and Manilla oranges. For better precision and standardised nomenclature, it would be well if our sweet oranges only are designated under the orange group and the loose jackets are designated by a different name such as Santras as in Western and Central India, Coorg loose jackets or Kamalas.

It is now well known that the conditions suitable for the commercial cultivation of these two distinct groups of citrus differ markedly from each other. While the loose jackets flourish even on hill slopes of poor fertility and under the heaviest precipitation, the optimum growth in sweet oranges is found to be in tracts where soils are comparatively more fertile and relatively dry conditions prevail. Great care and intensive cultural practices are the key notes of success in the sweet orange farming, as against the almost primitive methods which seem to suffice for the production of the loose jackets. Medical science and popular fancies have put a greater premium on the quality of sweet orange, and this coupled with high cost of production of sweet orange has made this fruit more valuable and therefore

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more expensive. In this paper an attempt is made to describe the sweet orange farming in Cuddapah district, in a tract reputed to produce the finest quality fruits in South India.

Sathgudi orange has been seen to come up best on well-drained red loamy soils. The water table in such soils at Kodur is at depths ranging from 20 to 30 feet.

Propagation. Seed propagation has been the rule. No particular care is taken in the selection of fruits for seed purposes. The fruits are cut when fresh and seeds extracted. Those that float on water are discarded and only the heavier ones which sink are utilised for sowing. The seeds are generally sown in the months of July and August, in seed beds at a distance of about 10 to 12 inches. Seeds take 25 to 35 days for germination. The seedlings are not transplanted to nursery beds for hardening but are directly lifted and planted out in the orchard when they are a year old. Since the public outside Kodur appear to have a great fancy for bigger size plants, most of the seedlings sold outside are about two to three years old.

Till about five years ago trade in such seedlings was carried on to the extent of over a lakh of plants per year, at an average of Re. 1 per seedling at the nursery. But after the establishment of the Fruit Research Station, the growers have come to recognise the value of vegetatively propagated plants. With the rapid popularisation of budded plants through the Fruit Research Station, Kodur and through several private nurseries started subsequently, there has however been a fast decline in the volume of trade and the price of the seedlings, so that, at present the supply of the budded plants from Kodur far outweighs that of seedlings, and the price of the latter is less than half of the former.

Lay out and planting. Two to three ploughings are given with the advent of the first rains of the North-East monsoon. Square system of planting is followed with a spacing of 9 yards either way. In November, pits $3' \times 3' \times 3'$ are dug, and they are left to weather till the middle of December. They are then filled up with the excavated earth, taking care to remove any clods or stones. Trees are lifted from seed beds by digging all round, and planted in December.

Irrigation. The seed beds are pot watered twice daily in the morning and in the evening, till the seedlings are about five months old. In the orchard, basins are formed around the tree soon after planting and pot watering is done. Another watering is given the next day, and thenceforth every alternate day for three months. With the setting in of the South-West monsoon the basins are widened and channels are formed. Water requirements are judged from a superficial examination of the soil surface. Growers prefer to give a shallow watering at short intervals to soaking irrigation at longer intervals. On an average, in a bearing plantation, about five to eight irrigations are given per month, depending on the soil texture and climatic conditions. The basins are widened to keep pace with the "drip" of the

leaves. No arrangements like sloping of the basins away from the tree is done to keep off water from the trunk of the tree. In some cases the purpose is achieved by heaping the soil under the trunk either in a mass or in the form of a ring. In older plantations flood method of irrigation is practised.

Manures and manuring. About five to six months after the seeds germinate, margosa cake at $1\frac{1}{2}$ lb. per cent. of land is applied to the seed beds in powder form. Besides serving as manure, the cake acts as a deterrent to pests. Double this dose is sometimes given when the plants are about a year old. No basal dressing of manure is given to the orchard before planting nor is any manure applied to the pits at the time of planting. Six to eight months after planting 1 lb. of margosa cake and $\frac{1}{2}$ a basket of well rotten farm yard manure per plant is applied. After that, till the third year after planting only farm yard manure is used, at the rate of 1 to 2 baskets per tree. From the fourth year onwards a mixture of 12 lb. of groundnut cake and 60 to 75 lb. of farm yard manure is given till the tree comes to bearing. Subsequently the following mixture is applied per tree.

12 lb. of groundnut cake,
9 lb. of fish manure,
3 lb. of bone-meal and
60 to 75 lb. of farm yard manure.

No green manure crops are grown. Manuring of bearing trees is done in the months of June-July or December-January, within the tree spread. The above practices are not followed by all the growers, but represent those adopted in some of the well-kept orchards.

Pruning. Six to eight months after planting out in the orchard, a light pruning of the low hanging and the intersecting branches is given. Subsequent pruning is limited to the removal of dead branches only. The branches are chopped off with scythes, without badly mutilating them and making the tree unsightly and pre-disposed to diseases.

Intercropping. Intercrops like turmeric, groundnut, ragi, *jonna, korra* and *arika* are grown till the sixth year after the trees are planted. The cultivation of tall intercrops like *jonna* has injurious effects on tree growth. Although leguminous crops may now and then find a place, these are being raised along with other intercrops without any adequate idea of the influence of such crops on the soil and the trees.

Blossoming. Seedling trees come into bearing from the seventh to the tenth year, while in the case of budded trees first flowering has been noticed on two to three-year-old plants. There are two flowering seasons in the year, one in February-March and the other in October-November. Some of the trees bear exclusively in one season. Most of them, however, flower in both the seasons. Some trees produce a third crop as well, in the period intervening between these two seasons. Subsequent to the tree coming into bearing, the time of manurial application is generally adjusted after studying the flowering habit of the trees.

Root pruning is one of the practices which is done in conjunction with the application of manure with a view to force flowering. Irrigatfon is gradually stopped until the trees just begin to show signs of wilting. The basins are then dug up 9" to 10" and manure is applied and covered. A copious irrigation is given soon after.

Fruiting and harvesting. Fruits mature in seven to eight months after flowering. Those of the October-November crop of flowers take a shorter time to mature, presumably because of the summer heat. Fruits are harvested when the colour changes from dark green to light green. Usually in order to reduce the expenditure on watching the orchard, the fruits are harvested in one lot irrespective of whether they have fully matured or not. Some growers defer harvest till the fruits turn yellow especially in the case of main crop, while others keep them on the tree for longer periods, sometimes even up to four to six months after maturity, with the hope of securing better prices. Such fruits are usually below standard, and in several cases, drop off prematurely causing great loss to the growers. Incidentally, it is believed that delayed harvest inhibits the setting of a better crop in the following seasons.

Improvements suggested. Although the seedlings are popularly believed to be more vigorous, hardier and more prolific bearers and more resistant to adverse environmental factors than vegetatively propagated plants, the fruit quality in them is generally so variable that it is impossible to secure anything like a standard crop. In seedling plantations very few trees are seen to bear good quality fruits, while a greater bulk of the crop is a mixture of fruits of varying shapes and sizes, and of variable quality. In budded plantations, however, the crop remains true to parent in respect of fruit quality; and therefore from the consumer's or economic point of view, the product will be of greater value. On a consideration of all these factors vegetatively propagated plants are to be preferred. Such plants may be either purchased from reliable nurseries or raised by the grower himself.

Water requirements of the soil are to be judged by examining the surface nine inches of soil and not by a superficial examination. The practice of giving shallow irrigation results in the matting of fibrous roots on the surface and these get cut during ploughing or digging. The constant destruction of fibrous roots is deleterious to the health of the trees and consequently to its growth and bearing. Soaking irrigations should be given so as to encourage root growth in the lower layers of soil and not to confine their activity to the surface layers which are subject to frequent disturbance by orchard soil culture. Irrigation basins in non-bearing plantations should be widened so as to give full scope for root development. In normal soils such basins should extend at least three to four feet away from the drip of the leaves. Investigations at the Fruit Research Station, Kodur, have shown that a budded orange plant on *gajanimma* after about 46 months of budding and with a top spread of only four and a

half feet had a horizontal root spread of about 39 feet. This fact indicates that tree spread is not a reliable index of the feeding area of roots, which though depending on the type of soils, root stocks, etc., nevertheless covers a very much larger orchard space than that actually encompassed by the top growth. The practice of provision of basins of 2 to 3 feet wide around the tree trunk for application of water and fertilisers is, therefore, hardly sufficient to give full benefits of these treatments, apart from leaving a greater part of the root zone unfed and unirrigated. Flood irrigation overcomes this defect, but this system encourages excessive weed growth and consequently leads to an increase in cultural expenses. The furrow method of irrigation usually resorted to in American orchards seems to be the ideal, and deserves a trial in our plantations as well.

The relative merits of application of manure in a single dose in the year or in a number of doses, are yet to be studied in all their bearings. But it can be safely stated that the application of bulky organic manures usually involves some root disturbance, which if done a number of times during the year or during an active growing period is bound to adversely affect the tree performance. Therefore, till we have the results of well-layed-out experiments the application of manures once a year, before the production of the main crop of flower may be safely advocated.

All manures should be applied in a manner to become readily available to the trees. The practice of spreading them too close to the trunk of the tree is wasteful and may cause serious injury to the trees. Many foreign fruit-growers prefer the furrow method of applying manure to applying them in basins, and the efficacy of this method in our orchards is to be tested.

Root pruning of citrus is definitely a weakening process. While its value in the regulation of crops cannot be denied under certain conditions, it has to be admitted that repeated annual pruning of roots may reduce the longevity of trees by progressively impairing their growth. In heavy soils, root pruning may produce some benefit by providing better soil aeration, but such a result is not likely to be of any importance in open soils. It is therefore advisable to find out how the effects of root pruning can be brought about by other and less severe orchard operations. At any rate, it appears necessary to suggest that root pruning may be resorted to only infrequently, once in two or three years in normal but shy-bearing groves. Annual root pruning cannot be advocated even in the case of very vigorous-growing and shy-bearing trees.

The importance of clean culture in the control of insect pests and diseases should not be overlooked. But experience in other parts of the world has clearly shown that clean culture can be overdone. As a matter of fact, there is now a distinct swing from clean culture to the minimum of soil disturbance, particularly in America and South Africa. At the present state of our knowledge, while the practice of leaving orchards to rank weed growth deserves to be condemned, we should guard against going to the

other extreme, and thus bring about results not only contrary to our expectations but also highly injurious to tree growth and soil conservation.

There is no doubt that with the progress of research, the orange cultural practices at Kodur or elsewhere are bound to undergo rapid changes. During the past five years alone as the result of the work done at the Fruit Research Station, Kodur, a number of changes is evident in some of the plantations. The popularity of budded plants has taken such a strong hold among the public that new seedling plantations appear to be very few and far between. This shows conclusively that fruit-growers as a class are generally very responsive to scientific advice and guidance, perhaps in a much better degree than the general class of agriculturists. In the present paper it has been possible to refer to only a few of the more important items on which improvements are necessary and possible.

The Artisan's Share in Agricultural Production.

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Introduction. The self-sufficiency of Indian villages has, in fact, disappeared, and it exists now only in the vision of the future. Although the old harmony is absent and there is no well-defined functioning of the various social groups for the welfare of the entire village, the inter-dependence of classes is readily apparent even at the present time. In no other occupation is such mutual dependence so frequently felt as in the agricultural pursuits which still dominate life in the country side. The farmers cultivate the land with cattle and human labour while they are continually helped by many others like carpenters, smiths and basket-makers who supply ploughs, spades, baskets and similar articles of deadstock which are essential in farming. These artisans function mainly as suppliers of agricultural implements and their services are constantly needed in agricultural production.

For a general appreciation of the place of implements in the agricultural economy, it is necessary to know the organisation and set-up of the farm. An analysis has to be made of the capital investment on holdings under such items as land, livestock, building and implements and see how much of each is used up in production. It will enable one to obtain a quantitative estimate of the different items which are indispensable in themselves, but are required in varying proportions. And if information is gathered as regards the individual items and the particular social groups responsible for the same, it will be helpful in apportioning the share of each in agriculture.

Tract surveyed. A survey was made in 1939—40 of 54 agricultural holdings in the Palghat taluk. Paddy is the main crop of the locality and its cultivation is the mainstay of the people. This one taluk accounts for nearly a fourth of the district acreage under rice cultivation, and had

207,445 acres under the crop in 1938—39, which represents 71·2 per cent. of the annual cultivated area.

Palghat is one of the ten taluks comprising the Malabar district, and is situated at the southernmost extremity bordering on the tamil country. Through the 'Palghat gap', the taluk constitutes the highway of communications between the rest of the district and the other parts of the Presidency. Possibly, too, geographical position partly explains the presence only in this taluk of *Gramam* and *Tara* which are so conspicuous in other South Indian villages but are totally absent in the other taluks of Malabar.

For convenience of revenue collection, Palghat taluk has been divided into six revenue *firkas*, each *firka* being composed of nearly twenty villages known as *amsoms* in the tract. The survey was systematically conducted in all the revenue *firkas* by selecting a few typical villages in each *firka*. The cultivators were chosen at random from the villages to represent the big, medium and small sizes af agricultural holdings. The total figures of all the holdings studied in each revenue *firka* have been used to calculate the average for the whole taluk.

The organisation of the holdings studied has been presented *firka*-war in Table I.

TABLE I

Revenue *Firka*.	No. of holdings studied.	Total area cropped on the holdings. (Acres)	Total capital investment on the holdings. (Rs.)	Capital investment per acre of cropped area.* (Rs)	Percentage capital investment on			
					Land.	Live-stock.	Buildings.	Implements.
1. Elapulli.	10	272·4	12142·5	44·6	69	17	10	4
2. Palghat town.	9	292·2	5791·8	19·8	48	27	15	10
3. Coyalmanna.	9	151·2	3263·5	21·6	26	33	34	7
4. Alathur.	9	312·0	5345·5	17·1	30	43	21	6
5. Kollengode.	8	345·0	5615·8	16·3	32	40	18	10
6. Parli.	9	183·6	3853·0	21·0	37	48	8	7
Average for the taluk.	9	259·4	6002·0	23·2	40	35	18	7

Share of Implements in Capital Investment. Having obtained from Table I a general picture of the equipment on holdings and the position of agricultural implements on it, let us examine the details regarding the different articles of dead-stock, and the classes of people who are directly engaged in its manufacture with a view to apportioning their share. Agricultural implements are very simple and they are made and mended by the village artisans. The 'country' ploughs, carts, levelling-boards and spades constitute the chief items of deadstock, and the carpenters and blacksmiths are jointly responsible for their manufacture. The basket-makers are a separate class who work with bamboos, reeds and palm-leaves, and make

* **Value of owned land not included.**

receptacles for farm use. The ploughs and spades serve as important tools in tillage, while the bullock-carts and baskets are often found necessary for the transfer of manures or produce. The expenditure on these village crafts are expressed as percentages in the accompanying Table II.

TABLE II

Revenue *firka*.	Total capital investment on implements on the holdings studied. (Rs.)	Total cropped area on the holdings studied. (Acres).	Capital investment on implements per acre of cropped area. (Rs.)	Percentage capital investment on implements.				
				Ploughs.	Levelling-boards.	Country carts.	Spades.	Basket work.
1	474·5	272·4	1·7	24	14	40	12	10
2	571·8	292·2	0·8	20	10	48	9	13
3	212·5	151·2	1·4	27	17	17	19	20
4	340·5	312·0	1·1	35	11	23	13	18
5	545·8	345·0	1·6	19	12	47	10	12
6	273·0	183·6	1·5	28	13	13	19	27
Average for the taluk.	403·0	259·4	1·7	25	13	31	14	17

The cost of materials, such as iron and wood, comes to nearly three-fourths of the price of the implements, while the remaining one-fourth forms the making charges which are shared among the artisans. It is distributed among the carpenters, the blacksmiths and the basket-makers, nearly a sixth of the wages going to the basket-makers while the carpenters and smiths share between them the rest. This is evident in Table III.

TABLE III

Revenue *firka*.	Total cropped area in the holdings studied.	Total investment on implements on the holdings studied.	Total share as wages (25% of the capital investment on implements).	Share as wages per acre of cropped area.	Share of different classes as percentage.	
					Carpenters and black smiths.	Basket-makers.
	Acres.	Rs.	Rs.	Rs.		
1.	272·4	474·5	118·6	0·4	90	10
2.	292·2	571·8	142·9	0·2	87	13
3.	151·2	212·5	53·1	0·4	80	20
4.	312·0	340·5	85·1	0·3	82	18
5.	345·0	545·8	136·4	0·4	88	12
6.	183·6	273·0	68·3	0·4	73	27
Average for the taluk.	259·4	403·0	100·8	0·4	83	17

It will be seen from Table I that in Palghat taluk Rs. 23·15 are needed as total average capital investment per acre of paddy cultivated, and also that 7 per cent. of this initial outlay or Rs. 1·7 is expended on agricultural implements. It has also been shown in Tables II and III that out of Rs. 1·7 spent per acre as capital on implements, 25 per cent. or Rs. 0·4 gets distributed as wages among the artisan class, the proportion of the share between

the carpenters and the smiths on the one hand and the basket-makers on the other, being as 4·9:1. With these average figures, a quantitative estimate of the share of artisans, as measured by the wages received, has been made for the whole taluk.

TABLE IV

Area sown under rice in Palghat taluk. (Acres.)	Capital investment on implements per acre of cropped area. Rs.	Total capital investment on implements in the taluk. Rs.	Artisan's share as wages per acre of cropped area. Rs.	Total share of the artisans in the taluk. Rs.
207,445	1·7	344,026·8	0·4	860,06·7

Share in Depreciation Charges. The economic life of the implements on the farm is so short that almost all through the year every farmer has to provide for some repair or replacement. Few articles survive their seasonal use and hence the services of the artisans are often found necessary. Their services are largely dependent upon the probable life of different implements, which may be estimated as under:

TABLE V

Implements.	Probable life (years).	Depreciation per cent.
Country carts	7 to 8	12·5
Levelling boards	3 to 4	25·0
Spades	1½ to 2	50·0
Ploughs	1 year	75·0
Basket-work	1 year	100·0

Based on the probable life of each implement, the depreciation charges have been worked out for the holdings in every *firka* and presented below:

TABLE VI

Revenue *firka*.	Capital investment on implements (Rs.)	Depreciation charges. (Rs.)	Depreciation per cent.
1.	474·5	212·2	44·6
2.	571·8	225·0	39·3
3.	212·5	118·6	55·6
4.	340·5	190·3	55·6
5.	545·8	215·3	39·5
6.	273·0	169·3	62·1
Average for the taluk.	403·0	188·4	46·8

The rather high rate of depreciation denotes the constant use of village crafts and the consequent employment of the artisans. The amount distributed as wages from the depreciation charges represents 25 per cent. which is the same as in the case of the initial outlay. The average depreciation per acre of cropped area works out to Rs. 0·7, and one-fourth of the amount gets disbursed as wages to the artisans. For the whole taluk with

an extent of 207,445 acres under paddy, the total share of the artisan class in the depreciation charges amounts to Rs. 150,605.

In working out the proportion of the shares in the disbursement of the depreciation charges, a deviation has been observed in that the share of the basket-maker has nearly doubled. This upward trend in favour of the basket-maker is no doubt due to the maximum depreciation in that particular item of deadstock. The shares received between the two different classes have been contrasted below:

TABLE VII

Revenue *Firka.*	Percentage share of implements in capital investment.		Percentage share of implements in depreciation charges.	
	Carpenters and blacksmiths.	Basket-makers.	Basket-makers.	Carpenters and blacksmiths.
1.	90	10	23	77
2.	87	13	32	68
3.	80	20	35	65
4.	82	18	32	68
5.	88	12	32	68
6.	73	27	43	57
Average for the taluk.	83	17	33	67

Conclusion. Valued at the market rate, i. e., Rs. 35 per cartload of 70 big measures, locally termed *para* and each *para* weighing about 16—18 lb., 1556·4 acres of cropped area in the holdings studied bring a gross return of Rs. 61,295·5 or Rs. 39·38 per acre. For cultivating one acre of paddy the average capital expenditure on farm implements is Rs. 1·7, while the total capital investment for the same is Rs. 23·2 The depreciation charges are rather high and works out, 46·76 per cent. Out of both the capital expenditure and the depreciation charges, 25 per cent. goes as wages to the artisans. Between them, the carpenters and the smiths carry the lion's share of the wages, while basket-makers get by far less, the proportion being respectively 4·9:1 in capital expenditure and 2:1 in the depreciation charges. The marked increase in the basketmaker's share in the depreciation charges is explained by the high rapid destruction of his item of deadstock.

An attempt has been made in the fore-going to determine how much the artisans get out of agriculture. But it is equally necessary to appreciate what agriculture owes to the artisans. Different classes serve differently and their services are not properly represented by arithmetic. Percentages and proportions convey little when they are used in comparing social values. What is more important is a proper recognition by the people that in agriculture, as in other walks of life, it is the mutual appreciation between parts that really builds up the harmony of the whole.

The Status and Study of the Insect Group 'Thysanoptera' in India.

By Dr. T. V. RAMAKRISHNA AYYAR, B. A., Ph. D.

Introduction. There are sufficient evidences to show that in India there exist numerous forms of the insect order *Thysanoptera,* known popularly as 'Thrips' but unfortunately our knowledge of these insects is extremely meagre. Neither Lefroy in his monumental work on 'Indian Insect Life,' nor Fletcher in his pioneer publication on 'South Indian Insects,' has done sufficient justice to this group of insects; the former makes mention of only two species from India, while the latter does not refer to even a single species of the order. While in other countries the group had attracted the serious attention of Entomologists long ago, as may be seen from the early works of eminent scientists like Uzel, Karny, Buffa, Haliday and Bagnall in Europe, and Hood, Hinds, Morgan and Moulton in America, we in India did not have a single worker on this group until comparatively recent years. Evidently the reasons for this neglect were perhaps due to the ignorance of the importance of this group in many ways.

General features and peculiarities. In spite of their small size the members of this insect order possess not only some remarkable structural characters which are absent among other insects, and worthy of study from the point of view of the pure entomologist, but the group possesses also some real importance to attract the interest of the economic entomologist. It may be noted that this group is one of the few insect orders of the original nine order classification, which have retained their primitive independent status unlike most others which have undergone radical changes at the hands of taxonomists. This feature of retaining the original status through decades is possibly due to the possession of some unique and striking morphological features quite characteristic and fundamentally different from members of the other insect orders. Speaking of their features, the structure of their wings and their peculiar feeding apparatus alone would afford ample room for intensive studies on the anatomy and physiology of these creatures. The members of this group are minute insects, the biggest among them not measuring more than $\frac{1}{3}''$ in length. The general form and the variations in the structural armature of their wings are quite characteristic. They are four winged like most of the insects, but these organs are small, narrow and provided with fine long fringes along the margins, a feature which is quite unique and which has gained for this order the name 'Thysanoptera' or 'fringewinged insects.' Here again in connection with the wing structure there are found numerous variations, some showing rudiments of wing veins, others quite veinless and then others which are megapterous, micropterous, brachypterous or even apterous; Trybom divides such forms into 8 groups in relation to their wing structure alone. The study of the wings alone of Thysanoptera might, therefore, be found a very

interesting study. In the same way the mouth parts are also curiously built in them; and the function performed by such a mechanism has not yet been sufficiently explained. Unlike as in other groups of insects the mouth parts show a curious asymmetry of the component structures; the right mandible is vestigial and not fully developed as the left one. The general features of the trophi appear to occupy a midway stage between the piercing sucking type and the biting chewing type and is generally called the rasping and sucking type. This asymmetry of the mouth parts and their evolution are worth special investigation, since such characters are not found among the members of any other insect order. Then again the structure of the limbs, which is also unique in one feature, has also gained for these insects the special designation 'Physopoda' or bladder-footed forms. This is characterised by the absence of claws to the tarsi and in its absence the presence of a bladder-like structure at the tarsal tips.

Life history and habits. Coming to the life histories and modes of behaviour of these little creatures we again find various features which are worth investigation. Among these insects reproduction takes place sexually and by oviposition, though some workers suggest that there are some viviparous forms. Though the order is brought under the category of 'Heterometabola' with regard to the phenomena of metamorphosis it is very interesting to find that the young ones before assuming the adult condition pass through what is called a 'Prepupa' stage, though the general formation, etc., of this stage are not at all similar to that in the Holometabolous groups like Lepidoptera or Hymenoptera. Almost the great majority of the Thysanoptera are vegetable feeders found on the softer tissues of various plants, their chief haunts being flowers; some exceptions have, however, been noted with regard to their food habits, a few species having been discovered feeding on mites, white flies and larvae of scale insects. Williams has recorded a blood sucking species in Trinidad, and another has been noted by Senevet as attacking man in Algeria. Some of the plant feeding forms have also developed a capacity for producing galls on their food plants, similar to gall flies or cynipids and we have some examples of these in India also. Very little is known of the natural enemies of these insects though the writer has noted a small anthocorid bug *Montadoniola thripoides*, B. feeding on a species of thrips in S. India and one internal Chalcid parasite (*Thripoctenus maculatus* W.) has recently been noted in the Punjab.

Economic importance. Since the food of most Thysanoptera consists of vegetable material, some species have developed tendencies to feed on cultivated plants of different kinds and occasionally assume the status of important crop pests. Studies so far made have also shown that we have some species of thrips which possess potentialities to become serious plant pests and cause appreciable loss to the cultivator. Among the more important of these in S. India are the *rice thrips*, the *chillies thrips* and the *grape thrips*. In some foreign countries some species of thrips are found

as very serious pests of important crops such as the bean thrips, the cacao thrips, olive thrips, etc. Apart from their status as plant pests, recent studies have also shown that Thysanoptera possess other potentialities also; some species have been found as effective weed controllers, some as vectors of virus diseases from plant to plant and some even as plant pollinators. In these various ways the group is developing economic importance both from the injurious and beneficial aspects of view.

Conclusion. A few words may be added (before I conclude this brief paper) on the work so far done on this group in India and the possibilities for future work. Until the year 1915 when the writer was attracted to this group only 14 species of Thysanoptera were known from the whole of India, though the earliest record of a species from India was in the year 1856. Within thirteen years (1928) through the efforts chiefly of one or two workers, the number of recorded Indian species rose from 14 to 126 and such work consisted chiefly in exploring only the plains of peninsular India. We can, therefore, have some idea of the possible wealth of Thysanopterous forms we can certainly expect, if the various regions of this large country are properly explored. The idea of presenting this brief note is, if possible, to attract the attention of young entomologists in India to this virgin field of entomology, possessing as it does not only avenues for investigation on many interesting scientific aspects and problems regarding a group of insects, but also the various economic features connected with these insects, a proper study of which, in these days, would go a great way to help the material welfare of our country.

EXTRACTS

Silage from sugarcane tops. A case in point is the almost universal practice of burning off sugarcane tops and trash each year after the harvest to facilitate ratooning operations or preparation for the next crop. This material is made up largely of the sugarcane top which is still in the green state at the time of cutting. Quite apart from the loss of potential humus this represents a loss of animal fodder which would be a valuable accessory in time of shortage of natural grazing.

From weighings carried out at the Agricultural College, Queensland, during 1940, it was found that the green weight of the cane top at the time of cutting was from one-third to one-half that of the cane cut from the same stem. A small area of cane at the College, comprising the varieties P. O. J. 2878, Co. 290, P. O. J. 213, Orambu and P. O. J. 2725 was consequently harvested and the tops ensiled in July 1939 in a shallow pit silo, 6 feet deep and 12 feet in diameter. A composite sample was chaffed and forwarded to the Agricultural Chemist for analysis. The tops were packed as uniformly as possible in the silo built 3 feet above the ground. After a few days of settling, more were added and 18 inches of soil placed on top to seal the silo. Considerable sinking took place as the silage settled down and fermentation set in and additional earth had to be placed on top. The temperature taken from the middle of the silo at no time exceeded 95°F.

The silo was opened in May, 1940. It was found that there was a wastage of 18 inches around the sides and on top of the silo, but the silage in the middle of the mass was of excellent colour and slightly acid in flavour. Owing to the small

size of the silo, the waste represented nearly 50 per cent. loss, but with a normal trench silo of 60 to 100 tons capacity the proportionate loss would be much less.

The silage was fed to the dairy cattle and they ate it readily with no harmful effects. A sample was also chaffed and forwarded to the Agricultural Chemist for analysis, who supplied the following figures :—

	Green tops per cent.	Ensilage. per cent.
Moisture	76·1	76·3
Crude Protein	1·8	1·4
Crude Ash	3·10	3·66
Crude Fat	0·30	0·26
Crude Fibre	7·60	8·55
Crude Carbohydrate	11·10	9·86
Lime	0 15	0·09
Phosphoric Acid	0·12	0·10

Unfortunately, no legume was available at the time for ensiling in conjunction with the sugarcane tops. This would undoubtedly have provided a better feeding mixture. However, it was sufficiently demonstrated that cane top ensilage can be easily made. (*The Queensland Agri. Journal,* Vol. 55, May 1941.)

Preparation of coconut shell charcoal. The shells are burnt in 40 gallon oil drums, the procedure being as follows:—

Preparation of drum. The drum should be free from any considerable leaks and if the bungs are of fusible metal they should be replaced by iron ones, or the bung holes closed by welding. The bottom should be cut out leaving a lip 2–3 inches wide around the outside. A circular cover is made of heavy galvanized or 16—20 gauge black iron and may be a flat disc or preferably slightly concial with a rise of about 3 inches in the centre. If a cone is made the seam must be welded or otherwise made air-tight. The cover should be of such size that it will just fit inside the rim of the drum and rest on the 2 inch lip. A few ⅛ inch holes (4—6) should be drilled round the top rim so that nails may be inserted to hold the cover in place when sealing the kiln. These holes must not be low enough to penetrate into the interior of the drum, thus allowing air leaks after sealing.

Site for burning. The drum is set up on level ground, preferably where it will be somewhat sheltered from any strong wind; but not so sheltered as to prevent air currents from reaching it. If improperly stoked the drum will give off dense volumes of white smoke, so that the burning should be done where the smoke will not become a nuisance. If stoked properly, there is practically no smoke.

Shells. The shells should be clean, fresh half-shells; old rotten shells that have been lying about for months will give a low yield, and shells that have been wet with sea water must be excluded.

Starting up. A single layer of shells is put in the bottom of the drum and a small fire of kindling wood started in the centre.

Burning. As soon as the shells catch and begin to burn fresh shells are added, one at a time and at a rate controlled by the results produced. This rate of feeding is the important factor. If the rate of feeding is too slow the shell will be over burnt. This can be judged by the colour of the flame which changes from yellow to bluish, and by the apperance of the charcoal which will be seen glowing and breaking into small pieces and becoming covered with white ash. The drums will also become intensely hot. The final product will have a low volatile content, but the yield of charcoal will be low. Too fast a rate of feeding will extinguish the flame, and give rise to dense clouds of white smoke, the

temperature of the drum will fall considerably and the fire will either be completely extinguished or give a product of half burned shell containing a high percentage of volatile matter. The yield of charcoal will, of course, be high under these conditions.

As the drum fills it will be found that a somewhat faster rate of feed can be maintained, especially if the shells are thrown in so as to stack up on the leeward side of the drum, where they become pre heated before rolling down into the burning zone. It is advisable to have a torch, consisting of a roll of oil soaked bag or similar material handy, so as to ignite the gas again if it becomes extinguished through too rapid feeding. With continuous feeding about 300 lb. (5 sacks) of half shells can be burned in a 40 gallon drum in five hours, and one man can probably burn more than one drum at a time if drums and shells are conveniently arranged.

Finishing off and sealing. When the drum is nearly full the feeding of shell is discontinued, and burning continued until the yellow hypocarbon flame has practically disappeared, giving place to a blue or purple monoxide flame. When this point is reached the lid is put on, fastened down by inserting nails or wires and sealed by placing a few shovelfuls of earth on top. It is essential that the air be completely excluded from the charcoal during cooling. The drum and contents are then allowed to cool undisturbed—probably four to six hours will be necessary, for, if the burning has been properly conducted, the lower part of the drum will be cool by the time it is filled. On opening up great care must be taken to avoid allowing earth to fall into the charcoal.

Yield. A normal yield is 23—25 per cent. i. e. 70—75 lb. charcoal per drum, while the volatile matter in the charcoal should be between 5 and 15 per cent. (*The New Guinea Agri. Gazette*, Vol. 7, No. 3, 1941.)

Gleanings.

World Rice Production Increased. During recent years production increased in Europe by 57%, in Africa 60%, in America 221%, in Australia 160% and in Asia only nine per cent. The general increase was 15% over the pre-war average which did not outdistance the increase in population. On an average, only eight per cent. of the total output of rice enters the world markets. Some of the chief Asiatic producing countries are also the chief importers. (A. Khan in *Rice News* May 10, Reproduced from *The Naric*, official organ of the National Rice and Corn Corporation, Manila, Philippines).

The "Topato". The cross of potatoes with tomatoes for the production of a crop above and below ground from the one plant has long been a stock joke at show dinners, but it can be done and has been done, according to a report by research workers in the United States. This is how they did it. Tomato tops were successfully grafted on to potato roots and, in due course, the top of the plant produced tomatoes and the roots potatoes. The potato produced is starchless, and the report says, "hailed as a boon to stout women who like potatoes, but shun them for fear of excess poundage". (*The Queensland Agri. Journal*, Vol. 55, May 1941).

A New Method of Plant Propagation. A new method of rooting plant cuttings without sand, peat, soil or other solid media has been under investigation since early January of this year. Based on the principle that cut stems suspended in the very moist atmosphere of a specially constructed box can develop perfectly normal roots, the method has already given promising results.

The experimental boxes are approximately 3 feet tall, 2 feet wide and 1 foot deep. Each box has a glass front and back; the former is set in grooves so that it can be opened to permit air circulation, and the latter is kept closed but enables observation of root development and of the moisture content in the back of the box. One-inch square removable shelves, made of ordinary builder's lath, are placed in a horizontal position about half-way in the box. A half-inch opening is left between shelves and vertical wooden strips are nailed on the sides of the box in front of the shelves to hold the shelves in place. A large piece of sheet rubber, with holes of the size of the cuttings to be inserted, is fitted securely immediately behind the shelves. The rubber functions to confine the moisture in the back of the box where it is most needed and to keep the cuttings in place. A water trough in the upper back part of the box from which strips of absorbent cloth are suspended supplies the moisture necessary to maintain the high humidity.

Successful rooting of a number of popular ornamentals, including Achyranthes, begonia, chrysanthemum, coleus, geranium, perennial phlox, ivy and Philodendron was achieved by this method in less than three weeks. Such plants were then successfully transplanted to soil in pots and have continued to develop normally. Dormant hardwood cuttings were placed in similar boxes in late January and early February. Vigorous roots developed in 6 to 8 weeks on *Hydrangea grandiflora*, *Deutzia crenata* and *Philadelphus coronarius.* Thes plants were also successfully transplanted to soil and have continued to grow normally.

In all the experimental boxes thus far used, root development was greatest in the vicinity of high moisture content and was either poor or entirely absent in those parts of the boxes where atmosphere was relatively dry. With improvements in methods of maintaining a saturated atmosphere in the vicinity of the cut stems in the back of the box, this new method promises to be useful not only to commercial growers but also to the amateur propagator. The special type of box in which the present investigations were conducted is tentatively called the "Rutgers Aero-propagator." *(Science,* Vol. 94, No. 2429; July 1941.)

Chemical lures for insect pests. Chemcial lures may eventually be used as protection for crops, instead of the barrages of poison spray with which plants have to be drenched now-a-days. It may become possible to mislead insect pests to lay their eggs in chemically scented traps. instead of on plants, was suggested by Dr. V. G. Dethier, of John Carroll University. Dr. Dethier has been experimenting with many kinds of insects and many kinds of chemical compounds found in plants, to get some idea of what induces certain species to lay their eggs on just one or a very few kinds of plants. The cabbage butterfly, which never lays its eggs on anything but the leaves of cabbages and related plants, was attracted by compounds found in just that group of plants. The orange puppy, a troublesome pest of citrus trees, is lured by the scent of two chemicals, citral and methyl-nonyl-ketone. The tent caterpillar has a decided preference for poison in small quantities: it hastened to a bait of hydrocyanic acid and benzaldehyde. Dr. Dethier demonstrated that insects are guided by their chemical sense by impregnating filter paper with the chemical compounds preferred by various species. Each insect went to the paper scented with its favorite luring odor and procceeded to make a meal of it, despite its lack of other resemblances to leaves and its obvious indigestibility. (*Science*, Vol. 94, No. 2429, Supplement, July 1941.)

Sun's rays for cooking food. Cooking by the sun's rays may be made easy with a new invention just granted U. S. Patent 2,247,830. It was issued to Dr. Charles G. Abbot, Secretary of the Smithsonian Institution, who has for a

number of years been experimenting with methods of using directly the energy from the sun. One object of the invention is "to provide a novel solar heater which is highly efficient, compact, cheap to manufacture, durable and easily used by the inexperienced". Another is that it "may be made of any desired small size without decreasing the efficiency." To collect the sun's rays there is a metal mirror, bent to the shape of a parabola. Its long direction is paralleled to the axis of the earth, and there is a clockwork to turn it during the day to follow the sun. In it, is a double-walled glass tube through which circulates a black liquid with a high boiling point. This absorbs the rays and is heated. The hot liquid then circulates through an oven at the upper end of the device, so that it may be used for cooking. (*Science*, Vol. 94, no. 2429. Supplement, July 1941.)

Research Notes.

"Teegapesara" (Telugu)—(*Phaseolus sublobatus* Roxb.) It is a leguminous creeper grown as forage and green manure crop in many parts of the Circars especially in the Godavari delta. It had been under cultivation for many years in this Province but unfortunately it has not been identified till now. A sample of seeds of this plant was obtained from Tanuku, West Godavari District, and plants were raised here. These plants have been identified as *Phaseolus sublobatus* Roxb. It is grown also in many parts of South Arcot and Trichinopoly districts as forage and green manure crop under the Tamil name Karumpayar and a detailed note on it has been published in the Madras Agricultural Journal, Vol. XXIX, No. 1, January 1941.

Herbarium, Agricultural College and Research Institute, Coimbatore. K. Cherian Jacob.

A Note on Some Preliminary Observation on the Time Spent by Indian Honeybees for Collecting Pollen and Nectar. The success of beekeeping depends on a very large number of factors. By far the most important of such factors is the usefulness for bees of plants found in a given locality. The present investigation, which for personal reasons the author found it difficult to complete, was undertaken chiefly with a view to secure data on the time spent by bees in collecting in a single trip the optimum load of pollen and nectar from the various pasturage plants available. The work was conducted in an apiary situated about 3 miles from the Coimbatore town.

It was necessary to mark bees for observation purposes. Parker (*J. Econ. Ent. 18:* 587—590, 1925) recommends a mixture of one part of a pigment, one part shellac and one-fourth to one part ethyl alcohol. This mixture was adopted with success using eosine for colouring. Bits of coloured tin foils such as those found wrapped round some chocolates were also affixed to the bees by means of the same mixture. As the bees alighted at the entrance of the hive which had been closed temporarily, they were quickly and gently pressed with the forefinger on the dorsal side of the thorax. They were caught in the fingers and removed. The colouring matter was then carefully applied on the dorsal side of the thorax without allowing the mixture to get on the wings or any other part. Exposure just for a few seconds was enough to allow the mark to dry up and the bees were then set at liberty. Where necessary, coloured tin foils previously cut and kept ready were also affixed on the mark immediately after it was made.

The time of arrival and departure from the hive of the bees were noted during their successive trips. By actual visit to the field they were known to be working in three tamarind trees growing about 60 to 100 feet from the hive. The data available indicated that the total number of trips made by bees visiting the same species (viz., tamarind) situated at the same distance from the apiary was different on the two successive days on which observations were made, perhaps due to some environmental factor which has not been ascertained. In the forenoons it took generally less than 15 minutes for the bees to bring nectar in one trip. As the day advanced this time interval increased reaching its zenith (about 30 minutes) between 2 and 4 P. M. On return to the hive after every trip the bees spent an average of about 6 minutes inside the hive. This time interval steadily increased from about 4 minutes at 7 A. M. to about 9 minutes at 6 P. M. Each bee spent daily over 9 hours in the field and about 3 hours in the aggregate inside the hive after every trip. The total number of trips made varied from 30 to 35 on the days of observation. It was also noted that in each tamarind flower the bees spent an average of about 15 seconds to collect nectar. Disregarding the time taken to fly to and from the hive, it appeared from computation that between 6 and 7 A. M. the bees visited 30 to 40 tamarind flowers for collecting enough nectar during each trip. This may increase even threefold in the afternoons.

Studies in determining the time taken for collecting pollen in one trip were made in the field on differently marked bees. The plants were situated within 100 feet from the bee hive, and the flowers found low enough to watch marked bees working on them. The observations were made between 7-30 and 9-30 A. M. during the respective months, and the results obtained are summarised below:—

Name of plant.	Month of observation.	Mean time per trip in minutes.
Leucaena glauca	December 1938	8·0
	May 1939	6·8
Cereus pterogonus	May 1939	7·8
Psidium guajava	January 1939	6·5

The available figures indicate that some differences in the "efficiency" of one species as compared with another exist as also differences on account of seasonal conditions. About 11 flowers on an average were visited by bees in each trip for collecting pollen from *Leucaena glauca* while in the case of *Psidium guajava* this was about 5 and in *Cereus pterogonus* only 2. As the time of the day advanced the number of flowers per trip visited by bees increased in every species. For collecting pollen in a single flower of *Leucaena glauca* an average of about 40 seconds were required.

Notwithstanding the efforts made by several workers in India to draw up as exhaustive a list as possible of the various bee flora our knowledge of the possible reactions particularly of nectar secretion in such bee flora to the varying climatological factors existing in India is meagre. A comparison of the interval of time taken by marked bees to complete a given number of trips during their foraging activites on various known species and spreading such observations over several years of known climatic conditions may perhaps give us a fuller idea of the part played by climatological factors for the larger or smaller honey crop one gets in some years. The efficiency of marked bees as judged by the time taken by them in collecting pollen and nectar may also be correlated with their biometry with a view to understand how far biometric characters affect their efficiency.

Agri. Res. Institute, Coimbatore.

R. Ratnam.

Correspondence.

To

The Editor, The Madras Agricultural Journal.

Sir,

Fairs and Shandies. A plea for more accommodation and better arrangement.

Fairs or shandies are the sole markets for nearly 90% of the produce of the country. These are the places where the bulk of the rural population buy their food and clothing, and sell their produce. Though most fairs have a shopping area of 5 to 10 acres, they are not usually large enough for the crowd of the people who gather there for buying and selling. There is of course a crude arrangement everywhere in a shandy but the space is so insufficient that most shopping spots have 1 to 2 and 3 persons for every square yard. Wholesale and retail trade is busily but clumsily going on everywhere. Business people and retailers are hurriedly striding here and there before they can get at their dusty commodity. The fairs as they are now, were perhaps suited to conditions 100 years ago but are utterly inadequate to meet modern conditions. The space is insufficient even for a quarter of the crowd. It is a pity that no attention is paid by the public or Government to improve them. These markets deserve an intelligent lead, arrangement and order.

It is for the sake of the people of the country-side, that these markets exist (and not for the tollsman or the sales tax); and the simple uncultured merchants have to pay the sales tax 2 to 3 and 4 times before a product leaves the *ryot* and reaches the consumer.

The seller and the buyer, and even the tollsman and the sales-tax, will each make a profit by a good arrangement of these country fairs, which are the material soul and life of the village or country as a whole, and no marketing board can ever be large enough to manage the work of these innumerable country fairs. If put on a new right track, these markets are likely to develop into self-managed good marketing boards.

Avarampalayam,
24—9—41

Yours etc.,
A. P. Krishnaswami Naidu.

Press Note.

Chinese Hand Power Groundnut Decorticator. The Chinese hand power decorticator consists of a wooden frame with an iron grating at the bottom. It has a segmental hopper and the rocker arm is swung backwards and forwards inside this hopper. Groundnut pods are dumped into it in small quantities and the swinging rocker is worked for shelling the produce. At the bottom of this rocker two pieces of channel shaped iron are fixed rigidly for effectively rubbing the pods against the round iron grids and breaking open the outer husk covering the kernels. Three different sizes of sieves are supplied with the machine and according to the size of the produce the correct sieve has to be used. For steady operation the decorticator is fixed firmly in the ground by digging small holes to take in the four legs and the earth is rammed round tight. Two men are required for working the machine, one woman or a boy to feed the hopper and two women for cleaning the shelled material and separating the kernels from the husk by hand winnowing. Working the machine steadily is not strenuous for the men and the operation can be continued for a whole day without extra exertion or the men getting over-tired.

About 200 pounds of pods can be shelled per hour and for a full working day, a machine can be made to deal with nearly 1,500 pounds. Labour charges are very low and the machine is also not very costly. There are no complicated mechanical parts which cannot be handled by an ordinary *ryot* in the villages. The cost of decorticating a bag of groundnut amounts to nearly one and a half to two annas and it compares very favourably with the charges levied by power decorticating factories. Another point in favour of this machine is the negligible amount of breakages in the case of mature produce. The *ryot* need not cart the produce in its bulky form with the shell to far away factories for decorticating. Shelling can be done in the village itself during liesure hours and labour is also available at a cheap rate in these places. The groundnut husk can be retained in the village itself and used as fuel. As the percentage of splits is very small, the buyers may offer a better price for the shelled material. Replacements of grids and all adjustments to the rocker arm are easily carried out without the use of spanners or other tools. The machine can be carried from place to place on the shoulders of two men. Its simple construction will enable it to be easily repaired by any village blacksmith and there are no parts which will get out of order or alignment. For the shelling of groundnut this is one of the best contrivances yet made available in the market.

For further particulars please apply to the Research Engineer, Lawley Road P. O., Coimbatore.

Note on the activities of the Department of Agriculture during July 1941. Lime fruit juice extracted and preserved by a simple process and at a cheap cost has been found to retain its flavour and quality after a period of one year. Those who are interested in the preservation of lime juice are requested to obtain detailed information from the Fruit Specialist, Fruit Research Station, Koduru, Cuddapah District.

There is a wide spread belief in Tinnevelly and Coimbatore Districts that a mixture of Uppam and Karunganni cottons gives a better yield than Karunganni alone. With a view to prove that this belief is unfounded a number of comparative tests were conducted in ryots' fields. The results obtained show that a mixture of Uppam and Karunganni yields less than pure Karunganni under identical conditions. The belief that a mixture gives better yield seems to have gained ground by the better appearance and better yield of Uppam plants at the cost of Karunganni plants which are suppressed. It is more profitable to grow Karunganni pure than as a mixture, both from the point of yield and from the point of the quality of lint. Uppam is an inferior variety compared to Karunganni.

There is a similar unfounded belief that Karunganni seed produced in Tinnevelly gives in Coimbatore better germination and better yield than the same seed grown locally. An experiment was therefore started at the Cotton Breeding Station, Coimbatore, to compare the yields of Karunganni cotton grown with the seed obtained from Tinnevelly and local seed. No difference was observed in yields of the two crops, showing thereby that the superiority attributed to the seed raised in Tinnevelly District has no foundation. In other words, the higher price paid for the seed obtained from Tinnevelly is an avoidable loss.

It is a common practice among *ryots* in certain places—particularly close to towns—to grow sorghum (*cholam* or *Jonna*) as a fodder crop to be fed green or convert it into hay. *Periamanjal cholam* in the south and *Pacha jonna* in the north are the varieties commonly grown for fodder. Good fodder *cholam* should give heavy yield of green matter and if it is to be relished and consumed by cattle to the last bit, its stalks should contain sweet juice and should not be pithy and

insipid. To meet these requirements two sweet juicy varieties have been evolved—one A. S. 3355 at Coimbatore and another N. 26/152 at Nandyal with high yielding characters. The variety A. S. 3355 yields nearly 30% over the local *Periamanjal cholam*, with 13% sweet content, while the variety N. 26/152 yields more than local *Pacha jonna* and has very sweet stalks. The two varieties are strongly recommended and all those who want to grow them are requested to apply to the Agricultural Demonstrator in their taluks for seed and any information regarding them.

The long felt need of a good variety of gingelly is met by a new strain S. I. 89 which has been recently evolved by the Oil Seeds Specialist. It is a high yielding bushy type which matures in 85 days. The seeds are red brown to black in colour and have 50% of oil content. It is fit for cultivation both as an irrigated crop and as an unirrigated crop. It gives an average increase of Rs. 3 per acre over the local crop.

Demonstrations: The following sales of seeds, implements, etc., and demonstrations and exhibitions were conducted during July 1941:

Sales:	1. *Implements.*		
		(i) Ploughs	89
		(ii) Intercultivators	1
		(iii) Other implements	35
		(iv) Spare parts	458
	2. *Seeds and Plants.*		
		(i) Paddy	2,09,104 lb.
		(ii) Millets	4,303 ,,
		(iii) Cotton	1,06,653 ,,
		(iv) Oil Seeds	9,186 ,, 172 No.
		(v) Sugarcane	9,400 setts 17 candies.
		(vi) Fodder Crops	2,944 slips 105 bags. 5,549 lb.
		(vii) Green Manure crops	16,886 lb.
		(viii) Plants and suckers	2,678 No.
	3. *Manures*:		141 tons. 792 bags. 28,293 lb.
	4. *Chemicals*:		289 packets. 2 tons. 1,201 lb.
	5. *Publications*:		2,358
Demonstrations:	1. *Trial Plots*:		
		(i) Varietal	133
		(ii) Cultural	5
		(iii) Manurial	18
	2. *Demonstration Plots*:		
		(i) Varietal	462
		(ii) Cultural	317
		(iii) Manurial	186

3. *Conservation of Farm Yard Manure.*

(i) Improving pits and heaps	4,852
(ii Introduction of dry earth system	720
(iii) Introduction of trench system	35
(iv) Introduction of loose box system	14
(v) Introduction of composts	235

4. *Insect Pests and Diseases*: 31,880 lb.
303 acres
17 trees

5. *Exhibitions and Lectures.* 138

6. Number of meetings held by the Agricultural Advisory Committees or Associations. 205

(Director of Agriculture, Madras).

Crop and Trade Reports.

Statistics—Paddy—1941-42—First report. The average of the areas under paddy in the Madras Province during the five years ending 1939-40 has represented 13·1 per cent. of the total area under paddy in India.

The area sown with paddy up to 25th September 1941 is estimated at 5,809,000 acres. When compared with the area of 6,437,000 acres estimated for the corresponding period of last year, it reveals a decrease of 9·8 per cent.

The estimated area is the same as that of last year in Bellary; an increase in area is revealed in Guntur, Coimbatore, Trichinopoly, the Southern districts and the Nilgiris and a decrease in area in the rest of the Province, especially in the Carnatic, the Circars, North Arcot and Salem.

The first crop of paddy is being harvested in parts of Chingleput, North Arcot, Salem, Coimbatore, Trichinopoly, Tanjore, Tinnevelly and the West Coast. The yield per acre is expected to be below normal in North Arcot and normal elsewhere. The condition of the standing crop is generally fair outside Vizagapatam, East Godavari, Kistna and Guntur.

The wholesale price of paddy, second sort, per imperial maund of 82$\frac{2}{7}$ lb. equivalent to 3,200 tolas as reported from important markets on 6th October 1941 was Rs. 3—13—0 in Vellore, Rs. 3—12—0 in Vizianagaram and Chittoor, Rs. 3-10-0 in Madura and Virudhunagar, Rs. 3-9-0 in Cocanada and Rajahmundry, Rs. 3-8-0 in Ellore and Guntur, Rs. 3—7—0 in Bezwada, Masulipatam and Trichinopoly, Rs. 3—6—0 in Tinnevelly, Rs. 3—3—0 in Hindupur, Rs. 3—2—0 in Kumbakonam, Rs. 2—15—0 in Conjeevaram, Rs. 2—11—0 in Cuddalore, and Rs. 2—9—0 in Negapatam. When compared with the prices published in the last report, i. e., those which prevailed on 10th February 1941 the prices reveal a rise of 49 per cent. in Madura, 42 per cent. in Conjeevaram, 39 per cent. in Vellore and Kumbakonam, 34 per cent. in Trichinopoly, 30 per cent. in Chittoor, 29 per cent. in Virudhunagar, 27 per cent. in Cocanada, 25 per cent. in Vizianagaram, 19 per cent. in Hindupur and Cuddalore, 13 per cent. in Tinnevelly, 11 per cent. in Negapatam, 6 per cent. in Ellore and Bezwada and 4 per cent. in Guntur, the prices remaining stationary in Rajahmundry and Masulipatam.

Statistics—Paddy—1941-42—Intermediate monthly report. The harvest of first crop of paddy has concluded in parts of East Godavari, Kistna, South Arcot, Salem, Coimbatore, Trichinopoly, the South and the West Coast. The yield per acre is expected to be generally normal. The condition of the main crop of paddy is generally satisfactory. In parts of Malabar second crop paddy was affected by insect pests.

The wholesale price of paddy, second sort, per imperial maund of 82 6/7 lb. equivalent to 3,200 tolas as reported from important markets on 3rd November 1941 was Rs. 3—13—0 in Madura, Rs. 3—12—0 in Chittoor and Virudhunagar, Rs. 3—10—0 in Vizianagaram, Masulipatam, Vellore and Tinnevelly, Rs. 3—8—0 in Cocanada, Ellore, Bezwada, Guntur and Trichinopoly, Rs. 3—6—0 in Rajahmundry and Negapatam, Rs. 3—2—0 in Anantapur, Hindupur and Kumbakonam, Rs. 3—1—0 in Conjeevaram and Rs. 2—11—0 in Cuddalore. When compared with the prices published in the last report, i. e., those which prevailed on 6th October 1941, the prices reveal a rise of about 20 per cent. in Negapatam, 7 per cent. in Tinnevelly, 5 per cent. in Masulipatam and Madura, 4 per cent. in Conjeeveram, 3 per cent. in Virudhunagar, 2 per cent. in Bezwada and Trichinopoly and a fall of about 5 per cent. in Rajahmundry and Vellore, 3 per cent. in Vizianagaram, 2 per cent. in Cocanada and Hindupur, the prices remaining stationary in Ellore, Guntur, Cuddalore, Chittoor and Kumbakonam.

Statistics—Crop—Sugarcane—1941—Second report. The average of the areas under sugarcane in the Madras Province during the five years ending 1939-40 has represented 2·9 per cent. of the total area under sugarcane in India.

The area planted with sugarcane up to 25th September 1941 is estimated at 104,990 acres. When compared with the area of 149,420 acres estimated for the corresponding period of the previous year, it reveals a decrease of 29·7 per cent.

The estimated area is the same as that of last year in South Kanara; a slight increase in area is revealed in Guntur, Kurnool and Tinnevelly and a decrease in area in the other districts of the Province, especially in Vizagapatam (–5,000 acres), Bellary (–4,000 acres), South Arcot (–9,000 acres), North Arcot (–4,800 acres), Salem (–4,000 acres) and Trichinopoly (–5,800 acres). The decrease in area is due mainly to the low price of jaggery at the time of planting.

The condition of the crop is fairly satisfactory. The seasonal factor for the Province as a whole works out to 96 per cent. as against 97 per cent. for the corresponding period of last year. The total yield for the Province is accordingly estimated at 305,450 tons of jaggery as against 444,400 tons (revised) for the corresponding period of last year, representing a decrease of 31·3 per cent.

The wholesale price of jaggery per imperial maund of 82 6/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 6th October 1941 was Rs. 5—14—0 in Mangalore, Rs. 4—15—0 in Adoni, Rs. 4—6—0 in Cuddalore, Vellore and Trichinopoly, Rs. 4—5—0 in Vizagapatam, Rs. 4—2—0 in Cocanada, Rajahmundry and Chittoor, Rs. 3—11—0 in Vizianagaram, Rs. 3—7—0 in Coimbatore, Rs. 3—5—0 in Salem and Rs. 3—4—0 in Bellary. When compared with the prices published in the last report, i. e. those which prevailed on 8th September 1941, these prices reveal a rise of approximately 6 per cent. in Trichinopoly and 5 per cent. in Vizagapatam and a fall of approximately 3 per cent. in Mangalore and 1 per cent. in Vellore, the prices remaining stationary in Vizianagaram, Cocanada, Rajahmundry, Adoni, Bellary, Cuddalore, Chittoor, Salem and Coimbatore.

Statistics—Crop—Sugarcane—Intermediate condition report. The condition of the sugarcane crop is generally satisfactory and the yield per acre is expected to be generally normal in all districts outside East Godavari.

The wholesale price of jaggery per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 3rd November 1941 was Rs. 5—8—0 in Mangalore, Rs. 5—0—0 in Vizagapatam, Rs. 4—15—0 in Adoni, Rs. 4—6—0 in Cuddalore and Trichinopoly, Rs. 4—2—0 in Vizianagaram, Cocanada, Rajahmundry and Chittoor, Rs. 4—0—0 in Vellore, Rs. 3—7—0 in Coimbatore, Rs. 3—5—0 in Salem and Rs. 3—3—0 in Bellary. When compared with the prices published in the last report, i. e., those which prevailed on 6th

October 1941, these prices reveal a rise of approximately 16 per cent. in Vizagapatam, and 12 per cent. in Vizianagaram and a fall of approximately nine per cent. in Vellore, six per cent. in Mangalore and two per cent. in Bellary, the prices remaining stationary in Cocanada, Rajamundry, Adoni, Cuddalore, Chittoor, Salem, Coimbatore and Trichinopoly.

Statistics—Crop—Gingelly—1941—42—Second report. The average of the areas under gingelly in the Madras Province during the five years ending 1939-40 has represented 15·8 per cent of the total area under gingelly in India.

The area sown with gingelly up to 25th September 1941 is estimated at 435,400 acres. When compared with the area of 437,100 acres estimated for the corresponding period of last year, it reveals a decrease of 0·4 per cent.

The estimated area is the same as that of last year in Guntur, Kurnool and Cuddapah; an increase in area is revealed in the Circars (Guntur excepted), Bellary, Trichinoply, Madura and the West Coast and a decrease in area in the rest of the Province, especially in South Arcot, North Arcot, Salem and Coimbatore.

The early crop of gingelly has been harvested in parts. The yield was generally below normal except in Coimbatore and Ramnad.

The main crop of gingelly has been affected, to some extent by drought in Kistna, Guntur, the Deccan and Salem. The condition of the crop is fairly satisfactory in the other districts of the Province.

The wholesale price of gingelly per imperial maund of 82 2/7 lb. equivalent to 3,200 tolas) as reported from important markets on 6th October 1941 was Rs. 7—4—0 in Cocanada, Rs. 7—3—0 in Cuddalore, Rs. 7—1—0 in Trichinopoly, Rs. 6—12—0 in Tinnevelly, Rs. 6—7—0 in Ellore and Tuticorin, Rs. 6—3—0 in Rajahmundry, Rs. 6—1—0 in Salem, Rs. 6—0—0 in Vizagapatam and Rs. 5—14—0 in Vizianagaram. When compared with the prices published in the last report i. e. those which prevailed on 4th August 1941, these prices reveal a rise of approximately 12 per cent. in Cuddalore, nine per cent. in Rajahmundry, four per cent. in Cocanada and Ellore, two per cent. in Vizagapatam and one per cent. in Tuticorn and a fall of approximately two per cent. in Vizianagaram, the prices remaining stationary in Salem, Trichinopoly and Tinnevelly.

Statistics—Crop—Gingelly—1941—42—Intermediate condition report. The gingelly crop has been affected to some extent by drought in Anantapur, Cuddapah and Nellore. The yield per acre is expected to be normal outside these districts.

The wholesale price of gingelly per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 3rd November, 1941 was Rs. 7-8-0 in Tinnevelly, Rs. 7-4-0 in Cocanada, Rs. 7-3-0 in Cuddalore, Rs. 7-1-0 in Salem, Rs. 6-15-0 in Trichinopoly, Rs. 6-6-0 in Tuticorin, Rs. 6-5-0 in Rajahmundry, Rs. 6-3-0 in Ellore, Rs. 6-0-0 in Vizagapatam and Rs. 5-14-0 in Vizianagaram. When compared with the prices published in the last report, i. e. those which prevailed on 6th October 1941, these prices reveal a rise of approximately 16 per cent. in Salem, 11 per cent. in Tinnevelly and two per cent. in Rajahmundry and a fall of approximately four per cent. in Ellore, two per cent. in Trichinopoly and one per cent. in Tuticorin, the prices remaining stationary in Vizagapatam, Vizianagaram, Cocanada and Cuddalore.

Statistics—Crop—Groundnut—1941—Intermediate condition report. The winter crop of groundnut has been affected to some extent by drought in the Circars, the Deccan, Salem and Tanjore, by heavy rains in Kistna and by the attack of red hairy catterpillar in parts of the Bhavani taluk of Coimbatore and of the Dindigul and Nilakottai taluks of Madura. The condition of the crop is generally satisfactory in the rest of the Province.

The wholesale price of groundnut (machine shelled) per imperial maund of 82⅞ lb. (equivalent to 3,200 tolas) as reported from important markets on 3rd November 1941 was Rs. 4-13-0 in Vizagapatam, Rs. 4-10-0 in Guntur, Rs. 4-9-0 in Cuddalore, Rs. 4-8-0 in Vizianagaram, Rs. 4-5-0 in Vellore, Rs. 4-3-0 in Nandyal, Rs. 4-2-0 in Tadpatri, Rs. 4-1-0 in Cuddapah, Rs. 4-0-0 in Salem and Coimbatore, Rs. 3-14-0 in adoni and Bellary, Rs. 3-12-0 in Hindupur and Rs. 3-1-0 in Guntakal. When compared with the prices published in the last report, i. e., those which prevailed on 6th October 1941, these prices reveal a rise of approximately nine per cent. in Adoni, seven per cent. in Bellary and Salem, five per cent. in Nandyal and Vellore and one per cent. in Vizagapatam and Cuddalore and a fall of approximately 14 per cent. in Guntakal, ten per cent. in Tadpatri, three per cent. in Guntur and Hindupur and 2 per cent. in Coimbatore, the prices remaining stationary in Vizianagaram and Cuddapah.

Statistics—Cotton—1941-42—Intermediate monthly report. In the Central districts and the South, the sowings of cotton are still in progress in parts. The area under the crop is expected to be normal or slightly above normal.

In the Deccan, the sowing of hingari or late cotton have concluded and the area is expected to be normal in Kurnool and above normal in the other districts. The crop is progressing well. The mungari or early sown cotton is in flowers and bolls. The yield per acre is expected to be below normal on account of drought.

The local cotton trade is not generally active at this time of the year. The average wholesale price of cotton lint per imperial maund of 82$\frac{2}{7}$ lb. or 3,200 tolas as reported from important markets on 3rd November 1941 was Rs. 17—5—0 for Cocanadas, Rs 20—9—0 for white Northerns, Rs. 18—2—0 for red Northerns, Rs. 15—3—0 for Westerns (Mungari), Rs 20-1-0 for Westerns (Jowari), Rs. 39-5-0 for Coimbatore Cambodia, Rs. 35—8—0 for Coimbatore Karunganni and Rs. 28-1-0 for Nadam Cotton. When compared with the prices published in the last report, i. e. those which prevailed on 6th October 1941, the prices reveal a fall of about 9 per cent. in the case of Westerns (jowari), 8 per cent. in the case of Westerns (Mungari), 4 per cent. in the case of Coimbatore Cambodia, and Nadam Cotton and 3 per cent. in the case of Coimbatore Karunganni, the prices remaining stationary in the case of Cocanadas and Northerns (red and white varieties).

(Director of Industries and Commerce, Madras.)

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 14th November 1941 amounted to 598,365 bales of 400 lb. lint as against an estimate of 503,500 bales of the total crop of 1940-41. The receipts in the corresponding period of the previous year were 481,296 bales. 542,238 bales mainly of pressed cotton were received at spinning mills and 59,601 bales were exported by sea while 103,718 bales were imported by sea mainly from Karachi and Bombay.

(Director of Agriculture, Madras).

Mofussil News and Notes.

Periodical Conference at the Agricultural Research Station, Samalkot. The Conference of the Gazetted Officers of the several Departments, in the district of East Godavari, was held at the Agricultural Research Station, Samalkot, on the 15th instant, under the presidentship of the District Collector, W. R. S. Sathianathan, Esq , I. C. S., Rao Saheb G. Jogiraju Pantulu and Sri. M. Pallamaraju, M. L. A., President, District Board, also attended. A paper on soil erosion and reports on the progress of work in model villages were read. Bee-keeping and other cottage industries also came in for consideration, at the meeting. The members were taken to the Farm museum and shown round and the work of the Station explained to them. M. S. N.

Exhibition—Victoria College, Palghat. A small agricultural exhibition was held in the Victoria College, Palghat from 24th to 26th October 1941 on the occasion of the Science Exhibition held in aid of the Madras War Fund.

Samples of improved paddy seeds, green manure seeds, posters on improved crops and control of insect pests and diseases, were exhibited with explanatory notes. Cooper 25 plough, Sprayer and live bee colonies were also put up. The extraction of honey and maintenance of bees in the colonies were actually demonstrated. Departmental publications were distributed to the visitors.

A. G.

College and Estate News.

Students' Club. There was a lecture by Sri. Srinivasachariar, Lecturer in Logic, Government Arts College, Coimbatore on the 23rd October. Sri. A. Adivi Reddi, B. Sc. III year class presided. The subject was "What am I?" The lecture delivered in very simple language was most elevating. There was another very interesting lecture on the 11th November by Rao Bahadur M. R. Ramaswami Sivan, retired Principal of the College on "The Institute of Agriculture, Anand" when R. C. Broadfoot, Principal of the College occupied the chair. A parliamentary debate was held on the 13th November on "That in the opinion of the house vivisection of India on communal basis is the only panacea for communal troubles". Sri. T. Chellappa of class III acted as the speaker and Sri. K. Subramaniam, Chairman, Coimbatore Municipal Council, kindly acted as the observer. There was a heated discussion and the motion was lost with the large majority voting against it.

Cricket. In the match played between the Agricultural College and the St. Joseph's College, Bangalore at Bangalore in September, in the Inter-Collegiate Tournaments, the latter won having scored 268 runs the Agricultural College team scored 70 runs in first innings and 102 in the second. The third match for the Rhondy shield was played on the 22nd October, between our college team and the Scouts Recreation Club, Coimbatore which we won by a narrow margin of 4 runs. A noteworthy feature of the game was the brilliant batting by Kothandaraman who scored 40; C. N. Babu scored 24 runs. In the match played on the 26th October between class I and II in connection with the Victory cup, class II won having scored 122 for 9, (Kamath 71, Tiruvengadam 26 both retired bat in hand).

Hockey. In a friendly match played on the 19th October between the Agricultural College and the Officers' Club, the former won by 2 goals to one. In another match played against the Officers' Club on the 24th October the College won by 3 goals to nil. In the match played in connection with the Coimbatore Hockey Tournament, between the Agricultural College and the Sporting Union, on the C. R. S. grounds, the College lost by the only goal scored towards the end.

Ladies' Club. The Agriculural College Ladies' Club organised a 'Fancy Sale' on Saturday the 15th instant. The 'Sale' was opened by Mrs. N. L. Dutt. It consisted of several sections, such as fancy articles stall, tea stall, vegetable stall, and side shows as 'lucky dip', 'treasure hunt', 'fortune telling', 'coconut shy' etc. The residents of the estate took keen interest and patronised the stalls and side show. The club premises were tastefully decorated and illuminated by multi-coloured lights.

St. John Ambulance Brigade. The A. C. R. I. Ambulance Division participated in the inspection of the Coimbatore Ambulance and Nursing Divisions conducted by the Surgeon-General to the Government of Madras in his capacity as the Commissioner for the Province, on the 14th October at Government College, Coimbatore.

Another batch of candidates completed their course of instruction in First Aid, and had their examination on the 31st October 1941.

Visitors. Mr. P. H. Rama Reddi, the Director of Agriculture camped at the Agricultural College from the 17th to the 21st. Dr. S. Ramanujam, Second Economic Botanist, New Delhi, visited the Institute and the Imperial Cane Breeding Station during the third week of the month.

THE ENTOMOLOGICAL SOCIETY OF INDIA

(South Indian Branch)

A meeting of the South Indian Branch of the Entomological Society of India was held on the 18th November 1941, at the Agricultural College and Research Institute, Coimbatore, with Mr. M. C. Cherian in the chair. After presenting the minutes and the financial statement, which were adopted, the secretary announced that Sri. M. C. Cherian had been nominated for the Presidentship of the Entomological Society of India and also for a membership on the Editorial Board, by Messrs T. V. Subramania Ayyar and P. N. Krishna Ayyar. The election of office bearers of the branch for the year 1942 was postponed to a future meeting.

Sri M. C. Cherian read a paper on Life history notes on *Grammodes stolida* Fabr., a pest on Daincha—*Sesbania bispinosa*, by M. C. Cherian and C. V. Sundaram; and Sri. P. N. Krishna Ayyar read a paper on *Habrobracon hebator*, Say., a parasite on *Dichomeris ianthe* on lucerne.

A number of interesting exhibits were shown by Messrs. M. C. Cherian, P. N. Krishna Ayyar and Janab Muhammad Basheer, the chief among which were:—

i. (a) *Tarache notabilis*, Wlk.—*Noctuidae*—appeared as a very severe pest on cotton in October 1937 in the Cotton Breeding Station at Coimbatore; long cycle pupae exist and moths sometimes emerge from the soil after 18 months. (b) *Tricholyga sarbillaans*, Wied—*Tachnidae*. Occurred as a parasite on the caterpillars of *Tarache notabilis* during the same season. (c) *Actia monticolla*, Mall. *Tachnidae*—another parasite on *Tarache notabilis*, though not so numerous as *Tricholyga*. (d) *Macroplectra nararia*, Moon—a Limacodid caterpillar that appeared as a pest defoliating *Pithecolobium dulce* in Coimbatore in December 1937. (e) *Fornicia ceylonica*, Wlk.—*Braconidae*—a sigalphine larval parasite of *Macroplectra nararia*—a single parasite issues from each host. (f) *Chelonus formosaria*—*Braconidae*—the parasite was recovered from *Prodenia litura* caterpillars on castor. It is truly an egg parasite and lays eggs in one-day old eggs of the host. The parasitised eggs hatch in the normal way into caterpillars and the parasitic eggs hatch subsequently in the body of the host and develop inside along with the host; a single grub comes out of each host and pupates in the soil. From each egg mass of the host about 100—200 parasites can be reared out. (g) *Apate submedia*, Wlk. This Bostrychid was found boring into living mango stems and branches at Udumalpet in 1935. As many as 5—6 tunnels were found in badly infested branches. The trees are said to die off in the course of a few years. (By Sri M. C. Cherian).

ii. (a) A carabid predator on *Sylepta derogata*. (b) Three species of *Eublemma*—*Eublemma scitula*, *Eublemma silicula* and *Eublemma trifasciata*—predaceous on Coccids on cotton, the last two being new records of their predaceous habits on Coccids. (By Sri P. N. Krishna Ayyar).

iii. (a) *Dermestes cadavernus*, Fb. Dermestidae—found doing considerable damage to stored groundnut kernels in the godowns at Pondicherry in March 1941. (b) *Gonocephalum* Sp., *Tenebrionidae*—found in large numbers in bags containing stored groundnut kernels at Pondicherry in March 1941; but no actual

damage is reported. (c) *Rhogas percurrens* Lyle. *Braconidae*—a specific parasite of *Achoea janata* caterpillars. (d) *Microplitis maculipennis*, Szep. another specific parasite of *Achoea janata* caterpillars in the early stages. (By Janab Muhammad Basheer).

It was resolved that the Editor, Entomological Journal of India, be requested to open a special feature in the Journal entitled—"Research items", wherein matters concerning research work of an incomplete but at the same time important nature as distinct from complete elaborate papers might be published on a line with what appears as "Scientific notes" in the "Journal of Economic Entomology".

Secretary, South Indian Branch.

OBITUARY

It is with profound sorrow that we record the death of Rao Bahadur K. Gopalakrishna Raju, L. Ag., Provincial Marketing Officer, Madras, on the night of 12th November 1941. He was born at Palamcottah, Tinnevelly District, on 3rd November 1890, and is a scion of a stock that has produced the late Rao Bahadur J. Chelvarangaraju, Deputy Director of Agriculture and the famous novelist, Sri J. Rangaraju. Sri Raju had his scholastic education in the Tinnevelly District and took his diploma in Agriculture from the Coimbatore Agricultural College in 1914. From his boyhood, he had made a mark by his intelligence. He entered the Agricultural Department soon after he left the College, was for some years a teaching assistant, and was promoted fairly very early in his service to the gazetted service as Acting Assistant Director of Agriculture, VI Circle in January 1920. From this period onwards, he had a meteoric rise, and was promoted as a Deputy Director of Agriculture in 1923. He held this post in various circles, such as, Bellary, Guntur, Madras, etc., and was appointed as the Headquarters Deputy Director of Agriculture at Madras in January 1934. In August of the same year, he became the Provincial Marketing Officer to the Government of Madras which post he continued to hold till his death. In recognition of his services to the agriculture of the Province he was awarded the title of Rao Bahadur in June 1939.

Raju was simple, intelligent, industrious and sociable with always a smile for everybody and was loved by one and all of his friends and colleagues. He was taking keen interest in the activities of the Union, and served in various capacities as a member of the Editorial Board, a member of the Managing Committee, Moffusil Vice-President etc. He was a lively member of the Agricultural College Officers' Club, occupying always a prominent place at the cards table.

We offer our deep and heartfelt sympathies to the bereaved family.

Departmental Notifications.

Subordinate Services.

Confirmation.

Sri. D. Viswanath Reddi, Agricultural Demonstrator, Proddatur, is confirmed as Upper Subordinate, Agricultural Section, New I grade on Rs. 145-190, with effect from 1st August 1939.

Transfers.

Name of officers.	From	To
Sri. M. Subrahmanya Chetti,	Asst. in Cotton, A. R. S. Guntur.	Asst. in the Cocanada Cotton Scheme, Guntur.
,, N. V. Kalyanasundaram,	F. M. Kalahasti,	A. D. Puttur.
,, S. Krishnamurthi,	A. D. under training, F. R. S. Koduru,	F. M. Agri. College Orchard, Coimbatore.
,, K. Krishna Hegde,	F. M. A. R. S. Nanjanad,	F. M. Sim's Park, Coonoor.
,, James Calaco,	F. M. Sim's Park, Coonoor,	F. M. Pomological Station Coonoor and to be in-charge of Kallar & Burliar Fruit Stations.
,, K. Govindankutty Kurup,	F. M. Pomological Station, Coonoor,	F. M. F. R. S. Koduru.
,, J. Gopala Rao,	F. M. F. R. S. Koduru,	A. D. Rayachoti.
,, M. Subba Reddi,	A. D. Rayachoti,	A. D. Venkatagiri.
,, R. Soundararajan,	F. M. Central Farm, Coimbatore,	Dairy Manager, Agri. College, Coimbatore.
,, V. Karunakaran Nayar,	Dairy Manager, Agri. College, Coimbatore,	A. D. Aruppukottai.
,, D. Shanmugasundaram,	A. D. Aruppukottai,	F. M., C. F., Coimbatore.

Leave.

Sri. C. Krishnan Nayar, Assistant in Mycology Section, Coimbatore, is granted leave on average pay for 4 months from 17th November 1941 and leave on half average pay for 2 years in continuation thereof *preparatory to retirement.*

Sri. A. G. Ramaswami Ayya, Sub-Assistant in Entomology Section, Coimbatore, is granted leave on average pay for 2 months from 10th November 1941 *preparatory to retirement.*

Name of officer.	Period of leave.
Sri. S. Ramachandra Ayyar, Entomology Asst., Coimbatore.	Extension of l. a. p. on m. c. for 4 months from 10-10-41.
,, K. S. Krishnamoorthi, A. D. Tanjore.	Extension of l. a. p. for 1 month from 5-11-41.
,, M. L. Narayana Reddi, A. A. D. Anakapalli.	L. a. p. on m. c. for 1 month from 1-11-41.

Sri. V. Achyutaramayya, A. D. Jami.	L. a. p. on m. c. for 3 months from 28-10-41.
,, S. R. Srinivasa Ayyangar, Librarian, Agri. College, Coimbatore.	L. a. p. for 1 month and 23 days from 1-11-41.
,, P. Satyanarayana, A. A. D. Markapur.	L. a. p. for 27 days from 3-11-41.
,, A. Venkobachari, A. A. D. Harpanahalli.	Extension of l. a. p. for 1 month from 5-10-41.
,, P. Krishnamurthi, A. A. D. Bobbili.	L. a. p. for 45 days from 1-10-41.
,, S. Varadarajulu Nayudu, A. D. Dhone.	L. a. p. for 2 months and 8 days from 16-10-41.
,, K. Kannan Nambiar, F. M. A. R. S. Nileshwar.	L. a. p. for one month from 28-10-41.
,, Ch. Venkatasaravayya Chetti, Asst. in Paddy (on leave).	Extension of l. a. p. for 1 month and 23 days from 1-11-41.
,, B. N. Padmanabha Ayyar, A. D. Puthur (Chittoor district).	L. a. p. for 2 months from the date of relief.
,, N. Ramadoss, A. D. (on leave).	Extension of l. a. p. for 1 month and 14 days from 10-11-41.
,, K. M. Narayanan, F. M. (on leave).	Extension of l. a. p. for 38 days from 16-11-41.
,, P. V. Somayajulu, Asst, in Mycology Section, Coimbatore.	L. a. p. for 4 months on m. c. from 3-11-41.
,, D. Bapayya, Foreign Service, under Tobacco Market Committee, Guntur.	Extension of l. a. p. for 3 months from 13-12-41.

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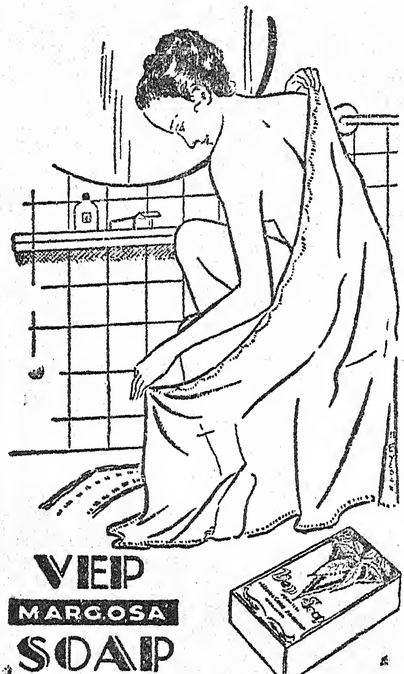

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TO LET

The Madras Agricultural Journal.
(ORGAN OF THE M. A. S. UNION)

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EDITORIAL

Geography and its relation to Agriculture. Today, owing to the tremendous progress made in the methods of quick transport and communication by land, water and air, no part of the world is isolated from the rest. The reality of the modern world as a living unit has been brought to the minds of thinking men and women. The meat production in Argentine or dairy-farming in New Zealand influences the cost of living in countries far distant; the failure of Indian monsoon, the unsettled political affairs in China, India or Russia may hamper industrial progress in Lancashire and in this way any incident of abnormal nature happening in any part of the world has its repercussions on the rest of the world. Every biologist knows that in the case of a living microscopic or macroscopic, animal or plant, that this is very true, namely, that the affection of a part, however slight it may be, upsets the whole. So is it in the case of the world unit. One of the aims of education is to impart a very liberal outlook, broad culture and a sound training for citizenship.

A very sound and thorough knowledge of the geography of the world, especially of countries which are agriculturally or industrially important is very essential to a student of Agriculture. In fact, it is best he is given a course in the subject, not from the examination point of view but for enabling him to understand and follow easily such important matters as the centres of origin of many of our cultivated plants, the geographical distribution of crops in relation to the world at large and to particular provinces of one's own country, the soils and climatological conditions which play an important part and determine the distribution of crops, the large markets of the world for agricultural and industrial commodities, the up-to-date routes by land, water and air which connect up the different parts of the world and a host of other economic problems of modern times, which are dealt with in a College of Agriculture. However well the professor may deal with the subjects just enumerated above, with world maps and epidiascope to help him, unless and until the student attending the lecture has the geographical picture clear in his mind's eye, it will be very difficult for him to derive the full benefit of the lecture.

The Bullock Cart. The reading public might have noticed the publication of a very interesting and thought provoking article entitled "The Economics of the Bullock cart" by A. Nageswara Ayyar, Retired Special Engineer to the Government of Madras, Road Development, in the Sunday Supplement of "the Hindu" of 16th November 1941. The bullock cart is one of the ancient but a most necessary item for every agriculturist. The author, an expert in the subject, has pointed out the defects in the construction of the bullock carts of today and suggests methods of improvement

which are within easy reach of an ordinary farmer. Discussing the subject of wear on roads, he states "That due to vehicles with pneumatic tyre equipment is the least "and adds" the cost of fitting pneumatic tyre equipment is very high and judging by the absence of enthusiasm on the part of the ordinary cart owner to fit it to his vehicle shows that the cost is beyond his capacity. In the case of the agricultural carts whose number is by far the largest in the province, they use the roads only in the non-agricultural season and even then a considerable part of their travel is over earth and village roads. The carts lie idle for a large part of the year. Pneumatic tyres for them will be very uneconomical as the rubber will perish by exposure even when the vehicles are not in use. If pneumatic tyred vehicles have to be brought to general use they can be done so only if Government or Local bodies subsidised the equipment manufacturers so that cart owners will be in a position to change over without considerable extra cost. This subsidy will not end with the initial change over but will have to be continued for every tyre renewal. The number of vehicles will run into several lakhs for the whole province. The subsidy will be very costly and as the damage to the road caused by lorries, buses and other motor vehicles will still remain as at present, it looks as though the cost of repairing the extra damage done to the road by the present bullock carts will be considerably less than what the subsidy will cost. Without such subsidy it is very doubtful if pneumatic tyred bullock carts will come into general use in any measurable length of time. Municipalities, Local Boards and big companies can no doubt be made to effect the change but this will be only a drop in the ocean and will make no appreciable difference in the road maintenance cost". To get over the problem of the wear on the road and to improve the cost in general it is suggested that the cart be fitted with well turned axles and hubs and arrangement be made for efficient lubrication and to quote his own words "What is urgently required is (1) the design of a good hub and axle capable of efficient lubrication without waste, and standardising it (2) making arrangements with local manufacturers to produce them in large scales and make them available to the cart owners at a price (to be fixed by Government) not much in excess of what the cartmen now have to pay. Yet another very important point suggested for our consideration is the widening of the tyres. It is pointed out that the prevalent feeling, that increase of tyre width would mean increase in weight of the wheels and their cost, is erroneous. The engineer says that widening of the rims can be effected by making them less deep and that by a judicious arrangement of the spokes the weight of the wheels can be kept the same as at present and yet made to give the present strength and service and as an example he cites the military carts which carry loads in no way less than the country carts but have only light wheels. It is, therefore, emphasized that what is urgently wanted is the design of standard wheel which will have a tyre width of 3 inches and will be as light and strong as the existing wheels.

Samai—The Little Millet—*Panicum miliare*, Lamk.*

By G. N. RANGASWAMI AYYANGAR, F. N. I., I. A. S.,
Millets Specialist and Geneticist, and Principal, Agricultural College,
AND
U. ACHYUTHA WARIAR, B. Sc. (Ag.),
Assistant, Millets Breeding Station,
Agricultural Research Institute, Coimbatore.

Origin. Very little literature is available regarding the place of origin of *Samai.* De Candolle (1884) does not make any reference to this crop in his "Origin of Cultivated Plants". According to Blatter and McCann (1935) "the crop is cultivated or naturalised throughout India and Ceylon; cultivated in the Tropics". Chevalier (1922) mentions that this species is cultivated only in British India and Ceylon, and perhaps also in Central China.

The fact that it has a name in almost all languages of India, and that its wild ancestor *P. psilopodium* is found abundantly in India, Burma and the Malay Peninsula, indicates that *Samai* was first brought into cultivation in India.

Distribution. *Samai* is grown to a limited extent in almost all the provinces of India. Its cultivation extends upto an elevation of 7,000 feet or more. It is found wild (probably escaped from cultivation) in the Punjab, Burma and South-Eastern Asia. It has very little importance outside India except probably in Ceylon where it is cultivated to a small extent. It has been tried, though not with much success, in the Straits Settlements and the Federated States of Malaya. The crop has also been tried on an experimental basis in many parts of Africa by the European settlers; but its cultivation there is unimportant (Sampson, 1936).

Botanical description. The description of *Samai* has been given by Hooker (1875), Gamble (1934), and Blatter and McCann (1935). Brief descriptions are also found in many books dealing with grasses. A comprehensive description based on the above authors is given below.

Panicum miliare, Lamk., belongs to the tribe *Paniceae* under Gramineae. Its specific name, *miliare*, is derived from the old latin *milium* meaning millet. An annual grass, with culms 30—90 cm. high, rather slender, erect or base geniculate, simple or branched; *leaves* linear 15 to 50 cm. or more in length, 12 to 25 mm. broad, gradually tapering from a broad base, glabrous or finely hairy; *Sheath*—rarely hairy with tubercled—based hairs; *Ligule*—a narrow row of hairs; *Node*—glabrous; *Panicle*—very compound, contracted or thyrsiform, often nodding, 15 to 45 cm. long; *Spikelet*—glabrous, rather flattened, suddenly cuspidate, 3—4·5 mm. long, mostly paired on unequal pedicels, but often solitary at the end of the branchlets, lanceolate in flower, elliptic or broadly elliptic in fruit. *Glume I.* Very broadly ovate, subtruncate, then suddenly acute, or scarcely acute, about

* Paper read before the meeting of the Association of Economic Biologists, Coimbatore on December 20, 1940.

1/3 the spikelet, white, membranous, 3—5 nerved, nerves arching and anastomosing. *Glume II.* Herbaceous ovate lanceolate, 11—13 nerved, almost as long as the spikelet. *Glume III.* Herbaceous, broadly ovate, 9 nerved, slightly shorter than *Glume II*, palea as long as the Glume (3—4 mm.), flower neuter or rarely with 3 stamens. *Glume IV.* Narrow elliptic, or elliptic-oblong to broadly ovate, acute, shining white or pale brown or dark brown, often 3—5 streaked dorsally; *Fruit* Caryopsis enclosed tightly within the fourth glume and its palea (2·5 to 3·5 mm.).

Note. Some of the samples of *Samai* collected from the Agency tracts of Ganjam and Vizagapatam are much taller (100—150 cm.) and later (120—140 days) than the types from other parts of the Presidency. These do not tiller so profusely as the short duration varieties, there being only 3—5 tillers, with each tiller bearing a good-sized head. The culm is stout, about 10--15 mm. in diameter and the leaves are proportionately large. The varieties maturing in 70—90 days are shorter in height, (30—70 cm.), tillering profusely, (upto 25 tillers), especially under irrigation. Secondary branching is quite common in these varieties. The main axis of the panicle is nodding especially after the grain has set.

Agricultural varieties. Names of agricultural varieties are usually descriptive of duration, grain and plant pigmentation, and panicle shape. It is of common knowledge that the wealth of varieties and varietal names show the antiquity and the importance of a crop in the locality. Basu (1890) mentions five varieties cultivated in Bengal (1) The Black or *Kariya*, most commonly cultivated (2) The white or *Charka* (3) The ant-headed *Dia-muri* of a motley colour (4) The *Burhi*, a late variety and (5) the *Bere*, a variety always grown mixed with ragi. In the Madras Presidency most of the samples collected have no special names except the general term *Samai*. However, a few had varietal names which are listed below with the characteristics of the samples.

Name and place of collection.	Duration in days.	Pigmentation.	Panicle.	Grain colour
Ajjamu, Kamakarai, Kollegal.	133	Mixture of P. and medium P.	Loose	Olive Brown (O Br.)
Aruppu Samai, Ramnad.	88	Mixture of P. and medium P.	Loose	Light olive brown (L O Br.)
Bele Samai, Mundigundum, Kollegal.	133	Medium P.	Branched and normal heads, half open panicles	Mixture of very light olive brown (VLOBr) and LOBr.
Chittan Samai, Reddiyur, Javadi Hills.	87	Mixture of P. and medium P.	Loose	LOBr.
Jupy Suwa, Monliguda, Jeypore.	108	Mixture of P. and G. T.	One-sided	Mixture of VLOBr. and LOBr.
Karboka Samai, Ambrampalayam, Pollachi.	81	Mixture of P. and medium P.	Compact	Mixture of LOBr. and OBr.

Kar Samai, Okkilipalayam, Pollachi.	83	Mixture of P. and medium P.	Compact	Mixture of LOBr. and OBr.
Kollu Samai, Kumblankolam, Palur.	102	Medium P.	Loose	Mixture of VLOBr. LOBr. and OBr.
Malligai Samai, Manapparai.	132	Medium P.	Loose	LOBr.
Pedda Samalu, Parvathipuram, Vizagapatam.	132	Mixture of P. and medium P. and G. T.	Mixture of dropping and erect panicles	Mixture of VLOBr. and LOBr.
Perum samai, Ramnad.	135	Medium P.	One-sided	LOBr.
Perum Samai, Kumblankolam, Palur.	106	Medium P.	One-sided	Mixture of VLOBr., LOBr. and OBr.
Porukku Samai, Ramnad.	135	Medium P.	One-sided	LOBr.
Punam Samai, Taliparamba.	127	Mixture of P. and G. T.	Arched	Mixture of VLOBr. & LOBr.
Sada Samai, Manapparai.	132	Medium P.	Branch and half open	LOBr.
Vellai Samai, Punganur.	87	Mixture of P. and Medium P.	Loose	LOBr.

Extent of cropping. Figures are not available to know the exact acreage of this crop in India. In the Madras Presidency the normal area under this crop is 589,940 acres. About 21% of this area is in Salem, 18% in Anantapur, 13% in each of Coimbatore and Madura, 8% in Tinnevelly and 6% in North Arcot. The districts of Trichinopoly, Vizagapatam, Chittoor, Bellary, Ramnad and Malabar grow this crop to a certain extent, but the area is below 5%. The crop is unimportant in the other districts.

The Role of Samai in the system of cropping. The importance of *Samai* as a crop is neither in the total area cultivated nor in the money return it gives to the cultivator, but that it gives something in the shape of food-grain to the ryot, from a soil which may otherwise yield little or nothing. It is a hardy crop which can withstand drought better than most of the other cereal crops and also water-logging to a certain degree. If the crop fails, the cultivator stands to lose very little, for the cost of production is very small and the assessment of the land very low.

Cultivation of Samai. Season. With the receipt of the sowing rains, the *ryot* attends first to the more valuable crops and then only to *Samai*. Naturally he reserves his best lands to his more profitable crops and

sows *Samai* in the poorer ones. Often it forms one of the mixtures and as such its sowing coincides with other dry land crops. It may be said that the sowing season of *Samai* is determined according to the advent of the South-West monsoon rains, i. e., June—July or August in the districts of Malabar, Coimbatore, Salem and Anantapur, the Agency tracts and in parts of Madura, Ramnad and Trichinopoly districts. In parts of Coimbatore and Tinnevelly districts it may also be sown in August—September. Rarely it is grown in April with the hot weather rains.

Rotations. The scope for rotations is very limited because of the nature of the soil on which it is sown. In single-crop dry lands of an inferior type as in the central division of Anantapur district, *Samai* follows horsegram in a two-year rotation. In parts of Salem, which are favoured by both the monsoons, *Samai* is sown in the South-West monsoon season and is followed by horsegram in the North-East monsoon. In parts of Tinnevelly near the Western Ghats, it is grown as a second crop in October—November after a cholam crop. In the uplands of Malabar and in Bengal, *Samai* follows dry land paddy or blackgram. In Bombay it follows *ragi* in dry lands. What is lacking by way of rotations is made up by mixed cropping. The usual crops grown as mixtures are *Samai, cumbu,* and *varagu,* among the cereals, lablab, horsegram and blackgram as pulses and occasionally mustard, gingelly and castor also.

Cultivation. *Samai* is cultivated only as a rainfed crop. It is seldom raised on garden lands, chiefly because better crops are selected for such lands and the increase in the outturn of *Samai* would very seldom pay for the cost of irrigation. With the advent of rains, the land is broken up with an ordinary plough. Two or three ploughings are usually given. Very little manure is applied, the available manure being used up for more paying crops. The seed is sown broadcast at the rate of about 10 lb. per acre, (when sown pure) and covered by ploughing once or twice. The field is sometimes levelled with a brush harrow or a levelling board. One weeding is usually given and nothing more is done until harvest time. This method of cultivation is common in almost all parts of India, the only exception being that the crop is sometimes transplanted in parts of Bombay. A special kind of cultivation of this millet, "the shifting cultivation" is prevalent in many hilly parts of India especially in Madras, Bombay, Bengal and Central India.

Harvest. The crop is cut close to the ground, tied up into sheaves and allowed to dry. When fully dry, it is threshed out by cattle if there is a sufficient quantity, or simply trodden down by foot. When cultivated on the hills, the crop is cut half-way leaving a stubble of 1½ to 2 ft. in length, which is subsequently burnt to form manure for the next crop.

Duration. *Samai* takes usually 3½ to 4 months to mature. There are varieties which mature in 2½ to 3 months. Some of the hill varieties from the Agency tracts take about five months to mature.

Yield. The yield varies from 200 to 500 lb. of grain and 800 to 900 lb. of straw (semi dry).

Grain. The grain is husked before cooking. The husk forms about a third of the grain. The husked grain is cooked like rice and eaten. In parts of Tinnevelly and Malabar the grain is boiled before husking, similar to the parboiling of paddy. The rice is sometimes ground into flour and cakes are made out of it. As a food, *Samai* rice is not very tasty and is seldom preferred to any other grain if available. According to Church (1886) the analysis of *Samai* grain is as shown below :—

Water		...	...	10·2
Albuminoid		...	...	9·1
Starch		...	...	69·1
Oil	...	...	...	3·6
Fibre	...	...	...	4·6
Ash	...	...	...	3·5

The nutritive ratio is 1: 8·4 and the nutrient value of 85.

Straw. The cattle are fond of the straw, but in South India as a fodder it is considered inferior to that of paddy and *ragi* straw. In Northern and Central India, the straw has little value as fodder. It is cut and put into the manure heap or simply burnt down to form ash for the next crop.

Anthesis and Pollination. The only record available is that published by Youngman and Roy (1923). They have stated that the time between the opening and closing of the flower is 15 to 20 minutes only. At Nagpur, the flowers open between 9-30 and 10-30 A. M. With the commencement of the opening of the glumes, the styles and the filaments spring out at once, with explosive suddenness. Self-pollination is the rule in this crop.

Detailed studies were made at the Millets Breeding Station, Coimbatore on the anthesis and pollination in *Samai* in the year 1936.

Emergence of the Panicle. As in the case of *ragi,* (Ayyangar and Wariar 1934) the flag, the leaf subtending the panicle, cannot be differentiated from other leaves and hence the emergence of the panicle which is contained in the sheath of the flag has to be closely watched. From the emergence of the tip of the flag from the last leaf-sheath, it takes four to five days for the appearance of the inflorescence. In many cases the inflorescence does not emerge completely from the sheath of the flag; the lowermost branches remaining inside.

Order of anthesis. The opening of the flowers commences on the second or third day after the appearance of the panicle. The flowering progresses from the top to the bottom of the panicle. The maximum number of flowers opens on the 6th or 7th day. It takes about a fortnight to complete the flowering in a panicle. Observations were also made on the period of opening of flowers. It shows that in fair weather, the flowers begin to open by 9 or 9-30 A. M. The flowering progresses rapidly upto 10-30 or 11 A. M. after which it begins to decrease gradually and stops by 11-30 A. M. If the weather is cloudy the flowers may continue to open

upto 12 noon, but not afterwards. Differences in the season of sowing or methods of cultivation do not affect the order of anthesis, or the period of opening of flowers in a day.

Detailed observations were made on a number of individual flowers. The following table gives the average time required for each stage of the anthesis.

Details of anthesis.

	Average time taken On a clear day. *min.*	Average time taken On a cloudy day. *min.*
Glume begins to gape	0	0
Stigma and anther visible (begin to emerge)	1	19
Anthers emerge (out of glume)	1½	19
Beginning of dehiscence	2	20
Completion of dehiscence	2	21
Stigma separate and become divergent	2	21
Glumes begin to close	3½	21
Glumes close completely	5½	22
Stigma begins to wither	6½	22
Stigma withers completely	19	28

The first sign of the opening of the flower is seen when the third glume slightly separates from the fourth glume. The palea then begins to separate itself gradually from the fourth glume. The opening of the flower is brought about partly by a swelling of the lodicules and partly by pushing from inside by the growing anthers. In fair weather, the opening of the flower is a quick process and is accomplished in one to three minutes. If the weather is cloudy the opening may take up to 20 minutes, the rest of the process being similar.

Within a minute of the gaping of the glume, the filament of the anthers elongate and by the time the glume is completely open, the three anthers as a column reach the mouth of the gaping glume with the stigmatic branches protruding from its periphery. The dehiscence of the anther takes place at the mouth of the glume or just before the anther reaches that position. The free pollen gets dusted on to the stigma. The filament then elongates and the anthers become pendant. As a result of this elongation of the filaments and spreading out of the anthers, the stylar arms that were caught up within these filaments are able to diverge and take up a position on either edge of the glume, exposing the two stigmas. The whole process of anthesis is fairly rapid and is completed in two or three minutes. Immediately after the anthers assume their pendant form, the glume begins to close. This closing is completed in about two minutes leaving the anthers and the stigma outside. A glume once closed never reopens. From the foregoing account it would be clear that self-pollination is the rule in this millet. The percentage of natural crosses occurring in *Samai* is very low (about 0·05).

Artificial Hybridisation. The artificial emasculation and pollination of this millet is rather a difficult process. However, the glumes can be opened and anthers removed with a fine-pointed forceps. The desired pollen can then be dusted on to the stigma. Such operated flowers are enclosed in a glass tube in order to exclude foreign pollen. The percentage of success depends mainly on the dexterity of the operator. An easier method of hybridisation is "the contact method" of crossing which is described in detail in connection with the anthesis and pollination in *ragi* (Ayyangar, and Wariar, 1. c). The percentage of F_1s obtained by this method ranges up to 5.

Inheritance of Characters. Anthocyanin Pigmentation. Two broad groups may be distinguished in *Samai*, one with purple pigmentation and the other without it, the "Green-throughouts". Among the purple-pigmented plants, two types are distinguishable and are designated, Purple and Medium purple. The characteristics of three types of pigmentation are given below.

Purple (*P*). In this type the pigmentation is manifested on the leaf, the leaf-sheath, the exposed internodes, the glumes and the stigma. The anthers are orange in colour. It is interesting to note that the node and the junction of the leaf are not coloured in any of the pigmented types.

Medium Purple *(Med. P.)* This type has the leaf, the leaf-sheath, the exposed internodes and the stigma coloured purple. The glumes are green and the anthers orange.

Green Throughout *(G. T.)* The plant is free from purple pigmentation on any of its parts. The anther is orange and the stigma colourless.

Crosses were made for elucidating the inter-relationship of these types of pigmentation. A cross between P. M. 21 (G. T.) and P. M. 31 (P.), gave the F_1 as Purple. In the F_2 it segregated into 53 P. and 18 G. T. indicating a 3:1 ratio. Another cross between P. M. 33, (G. T.) and P. M. 27, (Medium P.), gave a Medium Purple F_1 and segregated for 56 Med. P. and 16 G. T. in the F_2 indicating a 3:1. A third cross between P. M. 27, (Med. P.) and P. M. 30 (P.), gave a Purple F_1 and segregated into 103 P. and 34 Med. P., showing a 3:1 ratio. Crosses were made between P. M. 33, (G. T.) and P. M. 31, (P.) which gave Purple in the F_1 and 64 Purple, 23 Med. P., and 27 G. T. in the F_2. Its behaviour is given below:—

Generation No.	Family No.	Behaviour P.	Behaviour Med. P.	Behaviour G. T.
	Parents	P. M. 31		P. M. 33
F_1	Cross P. M. XII and XIII	F_1		
F_2	P. M. 133 and 134	64	23	27
	X^2 = ·33 P between ·8 and ·9.			
F_3 (From P.M. 133)	1 family	89		
	2 families	141	44	
	3 families	90		31
	5 families	142	45	58
	3 families		176	
	3 families		111	38
	2 families			72

A Factor P is responsible for the production of Purple pigmentation on the body of the plant and stigma of the flower, thus giving a Medium purple plant. P is a simple dominant to p the Green-throughouts. A factor H colours the glume purple thus producing a Purple plant. H is a simple dominant to h. The effect of H is noticeable only in the presence of P. The interplay of these two factors P and H thus results in a 9 : 3 : 4 ratio of P. (PP HH) : Med. P. (PP hh) : G. T. (pp HH or pphh). The behaviour is parallel to the one observed in *Eleusine coracana* (Ayyangar *et al*, 1933).

Grain Colour. Grain colour in *Samai* can be grouped into three types viz., very light olive-brown or the white grain ; Light olive-brown and olive-brown, popularly known as *Karum Samai* or *Nalla Samalu* in Madras and as *Kariya* in Bengal. The inter-relationship of these three types has been worked out and is presented below.

A natural cross, P. M. 167, having a very light olive-brown grain was spotted in P. M. 21, a Light olive-brown grained type. In the F_2, it segregated into 98 Very light olive-brown and 29 Light olive-brown grains, indicating a monogenic segregation. Another family, P. M. 60 (Light olive-brown grain) segregated for 103 Light olive-brown and 41 Olive-brown grains showing a 3 : 1 ratio. Having observed these monogenic differences between successive groups, crosses were made between P. M. 33, Very light olive-brown and P. M. 20, Olive-brown type. The F_1 had Very light olive-brown grain. In the F_2 there were 22 Very light olive-brown, 18 Light olive-brown and 2 Olive-brown grained plants, a ratio suggesting a 9 : 6 : 1. The F_3 behaviour given in the accompanying table confirms the ratio obtained in the F_2.

Generation No.	Family No.	Behaviour		
		Very light olive-brown	Light olive-brown	Olive-brown
	Parents	P. M. 20		P. M. 33
F_1	Cross P. M. XIX	F_1		
F_2	P. M. 136	22	18	2
	X^2 = ·55 P between ·7 and ·8			
F_3	2 families	190		
	6 families	277	89	
	4 families	166	108	17
	5 families		484	147
	3 families		353	
	2 families			187

Two additive factors I_1 and I_2 act as inhibitors on the olive-brown grain (X), the colour base. When any one of these factors is present, the colour of the grain is Light Olive-brown and when both are present, the grain becomes Very light olive-brown or white, thus giving a factorial composition of i_1i_2X for Olive Brown, i_1I_2X or I_1i_2X for Light olive-brown and I_1I_2X for Very light olive-brown grain. These factors have no relation with the plant purple pigmentation groups.

Albinism. One family P. M. 217, when sown was found to segregate for green and albino seedlings. Counts taken from P. M. 217 gave 1044 green seedlings and 72 albino seedlings showing a 15:1 ratio of green to albino. From the surviving greens fortyfive single plants were carried to the F_3 generation. Of these nineteen were pure for green seedlings fourteen segregated for green and albino as 3:1, while twelve gave 15:1 ratio of green to albino.

Generation No.	Family No.	Behaviour Green	Albino	
F_2	P. M. 217	1044	72	$X^2 = \cdot06$
F_3	19 Families (pure)	1637		$P > \cdot8$
P. M. 217	14 Families (3 : 1)	1315	421	
(1—45)	12 Families (15 : 1)	1590	109	

As in the case of *Eleusine coracana* (Ayyangar and Krishna Rao, 1931) two factors C_1 and C_2 are responsible either alone or together for the production of chlorophyll in *Samai* also. In the absence of both of these factors, the plant is an albino and dies off in about ten days.

Pests and Diseases. There is no record to show that this crop is subject to the attack of any serious insect pest. *Samai* (Butler 1918) is subjected to the attack of a fungus known as *Uromyces linearis*, B. and Br. The fungus is known only in India, Ceylon and the Phillippine islands and no information is available as to the extent of the damage which it causes. It is a rust affecting the leaves of the plant.

Summary. This paper presents a brief account of a minor millet, *Samai—Panicum miliare*, Lamk.

Studies on anthesis and pollination have shown that the flowers open between 9 A. M. and 12 noon under Coimbatore conditions and that self-pollination is the rule. Emasculation and artificial pollination can be done with a fair amount of success. Very good results can also be obtained by "contact crosses".

Two types of purple pigmented plants, Purple (PH) and Medium purple (Ph) are met with, while with p, the plant is green-throughout. A segregation where these three groups occur has given a 9 : 3 : 4 ratio of P, Med. P and G. T.

Three types of grain colour viz, Very light olive-Brown, Light olive-brown and Olive-brown occur in *Samai* by the interaction of two additive factors I_1 and I_2, inhibitory in effect on Olive-brown grain.

Albinism was noted in the seedlings of *Samai*. Duplicate factors C_1 and C_2 are responsible for the production of chlorophyll either alone or together.

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The "Nendran" or Malabar Plantain.

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The Nendran is a type of plantain chiefly grown on the West Coast of the Presidency and abundantly in Malabar. Although sporadic efforts have been made to grow this crop in other parts of the Province, it has not been successful outside Malabar and parts of South Kanara. Probably the partiality of this crop for the porous well drained laterite soil and the heavy rainfall of the Coast is responsible for its coming up well only in these tracts.

Uses. The fruits both raw and ripe are available in important towns of Malabar all the year round. It is much bigger than the ordinary plantain fruit, and is a favourite among the people of the West Coast. It forms a part of the New Year present on "Vishu" from the tenant to the landlord or on festive occasions like 'Onam', etc. Both ripe and raw fruits are used in all households in various ways. The raw fruit is used for culinary purposes either by itself or mixed with other vegetables. After peeling the skin and slicing, the well matured fruits are fried in oil and preserved either salted or sweetened in jaggery syrup. The ripe fruits are consumed either in their natural state or by cooking in steam or baking in hot cinders. They are best eaten when the rind becomes flecked. The fruits are largely used in the preparation of 'prathaman', 'halva', fruit salad and many other sweets

and can also be preserved either in honey or syrup. 'Figs' are prepared by slicing well ripe fruits whose rind has been removed, and dried in the hot sun for 4—5 days.

The pulp of fruit is rather hard compared with other varieties of plantains and keep for fairly long period (10—15 days) after ripening and do not easily fall off from the bunch. Due to the keeping quality, the export trade of this commodity of late, to particularly large towns such as Madras, Trichinopoly, Madura and Coimbatore has been on the increase.

Like the coconut tree, almost every part of the plant is useful. The fruits, flower, flower stalk, and the rhizomes of the suckers are edible, while the sun-dried fibre is a good substitute for coir and other ropes. Usually no leaves are cut from the mother plant but the dry leaves are used for thatching sheds, etc.

Varieties. The chief varieties are *Nendran, Attunendran, Nananendran, Nedunendran, Tiruvodan, Chengaikodan, Myndoli, Kudiraivoly,* etc. They vary in duration, size of bunch, number, size, shape and taste of fruits, etc.

Cultivation. *Season.* Unlike other ordinary plantains, *Nendran* is not ratooned but fresh plantings done every year. The two main seasons of plantings are (i) with the outbreak of the N—E. monsoon in September and (ii) during November at the close of the rains. As off season fruits fetch better prices, wherever facilities exist, planting is resorted to during other months of the year also.

Planting. Planting is done both in wet and garden lands. As the crop cannot stand waterlogging the land selected should be well drained. As it needs copious irrigations also, facilities should be provided for watering the plants, when there is no rain. Pits large enough to hold the rhizomes are dug in the fallow field before planting is not usually resorted to. The land is dug up with a mammotee before pits are dug.

Seed material. Suckers taken from plants that have not flowered, are considered unsuitable as planting material. Suckers that sprout right below the bunch of the mother tree and the one just opposite to it are generally preferred for planting as they are supposed to yield big bunches. When these are not available all the available good suckers are planted. The suckers may be planted either as fresh ones immediately after digging them out or after they are dried in the sun. In either case topping is done nearly a foot above the rhizome. It is not an uncommon practice to have the stems of the planted suckers, trampled under the feet of buffalo. In this case the new shoots that sprout are more vigorous than the one coming out of a freshly planted sucker. Fresh suckers planted put forth new shoots within a week while the dried ones take from 15—30 days for putting forth new sprouts.

Manure. As the rhizomes are damaged by the grubs of rhinoceros beetle, no cattle manure is usually applied. A handful of ashes is put in the pit at the time of planting. When the young plants have put forth 3-4 leaves the base is opened and green leaf (about 20 lb.) and ashes (5 lb.)

are applied and covered. A second and bigger dose of the above manure is applied when the crop is about 3-4 months old. Some people give a third application of the same manure after 2 months from the date of second application. Burnt earth is considered a good manure. Though the crop responds well to application of concentrated manures it is beyond the reach of ordinary cultivators on the West Coast and as such not resorted to.

After cultivation. Inter-cultivation by use of bullock power is not practised. The field is usually dug up with mammottee after the first manuring is done and the plants are simultaneously earthed up. A second and third digging and earthing up may be given if necessary according to the nature of the condition of the field. It is advisable and often necessary to prop up the flowered plants by means of dead standards in order to avoid breaking of the plants during high winds. In wetlands, cross drains will have to be dug between every two rows of plantains to drain away the excess water. These can be utilised as irrigation channels as well.

Irrigation. Where flow irrigation is possible, it is naturally economical to make free use of this water. The fields are flooded when necessary and all the surplus water is drained away. Usually the plantain cultivation is done under lift by picotah. Where sub-soil spring is high, pits are dug in the middle of the plantation and water is baled out by human-labour in pots and supplied to the plants. The interval between irrigations will naturally depend upon the method of supply and quantity applied. Copious irrigations are considered necessary after the plants attain full growth and put forth bunches.

Fruits. Bunches begin to appear 7—9 months after planting depending upon the treatment received and the variety planted. The plants will then be 7—8 ft. high and would have produced about 30 leaves half of which will still be green and fresh.

Each bunch will have 4—5 hands and from 30—50 fruits. It is not uncommon to see big bunches with 60—70 fruits. When all the hands have formed, the flower is cut away so that the fruits will have maximum advantages for growth. The bunch will begin to ripen 3 months from the date of flowering. For culinary purposes harvest will commence even after 2nd month. The average weight of a bunch with 50 fingers will be 20—25 lb. depending upon the size of the fruits.

Economics. The following is a rough estimate of the cost of cultivating an acre and the return that can be expected in normal seasons.

Cost of cultivation.

	Rs.	As.	Ps.
Cost of preparing the land	6	0	0
Cost of 700 suckers	21	14	0
Digging pits and planting	9	0	0
2 diggings and earthing up and providing standards	20	0	0
Irrigation	22	0	0
Total.	78	14	0

Receipts.

600 bunches of 40 fruits each	24000			
100 ,, 30 ,,	3000			
Total.	27000			
@ Re. 1 per 100		270	0	0
700 saleable suckers		21	14	0
Cost of fibre, flowers, etc.		14	0	0
Total.		305	14	0

Net profit per acre. Rs. 227 or 225. More profit can be obtained in seasons of favourable price or if all the suckers produced are sold as seed material.

Conclusion. Cultivation of *Nendran* plantain is generally very paying and it is sure to tempt anybody in venturing on a large scale plantation. But there is the other side of this picture. In spite of all precautions taken very often large areas of this crop are damaged by high cyclonic winds causing irreparable loss to the ryots. The loss in such cases will be immense especially if large areas are owned by one individual. For this reason large areas are conjointly cultivated by many ryots or each individual owns only a limited number of plants. The *Nendran* is and will continue to be the plantain of Malabar.

Ecological Notes on the Sugarcane stem borer *(Argyria, sticticraspis*, Hmp*)* in the Irwin Canal Area, Mysore.

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Introduction. The observations recorded in this paper were made in 1938 in a small plot $\frac{1}{4}$ acre in extent, situated amidst large blocks of sugarcane at Satnur Farm 3 miles from Mandya in the Irwin Canal tract, Mysore. This plot was divided into ten equal sub-plots of one gunta ($\frac{1}{40}$ acre) each which were planted, one in the middle of every month from February to November 1938. The observations recorded herein were made on each month's planting from the third till the twelfth week after planting. No control measures of any kind against the borer were undertaken, and there was no other deviation from the usual cultivation routine.

This work was undertaken with the purpose of obtaining comprehensive data relating to (a) Egg-deposition rate of *Argyria sticticraspis* Hmp* in different months of the planting year, (b) the percentage of egg mortality due to the egg-parasite *(Trichogramma minutum*, Riley) and other natural factors, and (c) the effect of the resultant hatch of larvae on the young crop. This enquiry was suggested to the author by Tucker's work (ii) in Barbados; but owing to the great difference in the bionomics of the pests concerned,

* No mention of *Diatraea Nenosata* Hmp, which also attacks sugarcane in its younger stages is made in the paper to avoid confusion, as its incidence is extremely slight.

and the methods of cultivation, a considerable deviation from his plan of work was inevitable.

The plot selected for this study, while situated in an extensive sugarcane block was carefully excluded from borer control work, so that, while allowing for normal incidence of attack, there was no artificial check imposed on the pest, or disturbance of the effect on it of its egg-parasite and other natural factors tending to reduce its severity. Thus the data presented in this paper are based on the incidence of the borer in its natural (without control) state and it is believed they can therefore be utilised as a working guide for the application of control measures on a field scale.

Methods of study. In each sub-plot 24 × 15 feet furrows in 3 rows (of 8 furrows each) were opened and 250 setts of H. M. 320 cane were planted in the middle of every month from February to November 1938. January and December were left out as it is not usual to plant sugarcane in those two months in this area. Irrigation, manuring and weeding were on the usual lines and at proper intervals. Observations were begun in the third week after planting and were continued till the twelfth week, after which a detailed study became difficult on account of the great mass of foliage developed by them. Besides, the marked diminution in the density of egg-laying as the crop approached this age made it unnecessary to continue weekly examinations beyond this age.

At every weekly examination every plant in the sub-plot concerned was carefully searched for *Argyria* egg-masses deposited on it. Immediately one was located, its condition (see below) together with the number of eggs in it was recorded. The egg-masses located at the weekly examinations fell into the following four categories, depending on the interval between actual oviposition and the day of examination. (a) *Fresh-laid.* Uniformly pale yellow or dirty white in colour, (b) *Parasitised.* Completely blackened, if parasites were still inside, or black egg-shells with a circular hole in the middle, if parasites had emerged, (c) *Hatched.* If hatching had occurred, pale silvery egg-shells were left intact; in eggs ripe for hatching, the larval head was seen as black spot in the middle of the yellow egg and these eggs were taken as hatched out for record purposes, and (d) *Damaged.* Torn open or eaten up entirely (by ants, etc.) with only silvery scar left of the individual eggs.

Obviously, except the fresh-laid eggs, those belonging to other categories were laid within about 3 days after the *previous* weekly examination so that there was sufficient time for them to show their final condition at the first examination. The number of eggs in such egg-masses and their condition were noted and they were then left in position. It is possible that a number of egg-masses washed away entirely by rain or irrigation water before examination have not come into account but as they could not have been numerous except during rains, and as they do not affect conclusions relating to egg parasitism or damage to crop, it is believed that they may not vitiate the data presented in this paper.

When a fresh-laid egg-mass was found, the blade or the leaf-sheath carrying it was marked in white lead and the plant noted with a stake near it. Such marked egg-masses were examined, first of all, at the next weekly examination and their fate—whether parasitised, hatched, damaged or washed away was duly noted. An egg-mass located at one examination was rarely missed at the next, and in fact whatever happened to it, unmistakable evidence of it was invariably available, thus showing that observations at intervals of less than a week were not necessary.

Thus, the history of a batch of egg-masses was normally fully worked out in two weeks.

Along with the study of egg-deposition on the above lines, the percentage of attack on the young crop in the sub-plot under examination was calculated by actually counting the number of dead hearts and healthy seedlings separately every week the observations were in progress. This served as a ready (if rough) index of *larval survival.* Except for merely counting them, dead hearts were not examined for the presence of larvae in them nor were they removed or disturbed otherwise.

Incidentally the percentage of germination for each month's planting was also calculated on the assumption that with 250 three-eye-bud setts planted in each sub-plot, 750 primary shoots would represent cent per cent germination. The progressive increase in the percentage of germination was worked out for each sub-plot from the first week of observation for 3 or 4 weeks afterwards till the last eye-bud had a chance to sprout.

The sub-plots were harvested in due course in 1939 and both the number of millable canes and the actual weight of cane obtained were recorded separately for each sub-plot. The various data collected in the course of these observations are presented in a condensed form in Tables I and II.

Discussion. (a) *Egg-deposition rate: Argyria* ovipositional activity reached its peak in May (on March and April planting) and was negligible in December on October and November-planted cane. This is in accord with field observations of borer incidence in general; summer planting is subject to serious borer attack while "B" season planting (planting after June) is usually fairly free from the pest. This difference in infestation between the two seasons of planting may be ascribed, among other reasons to the effect of rain, beneficial to the crop, and adverse to the pest. The "B" season crop is more vigorous and profuse in tillers than the earlier planting; for the pest, ovipositional activity is greatly reduced (see below) and a number of egg-masses are washed away before hatching.

Further, in every sub-plot there was heavier egg laying in the first half of the period of observation than in the second half, i. e., the crop during the first month after germination appears to be more attractive for egg laying than in the second month, as seen from the following table :—

TABLE I. Planting, Germination, Borer attack, and Harvest data.

Planting.		Germination.		Borer-attack.				Harvest.				Remarks.
Month.	Date.	Percentage.	Recorded on	Total No. shoots.	Number healthy.	Number attacked.	Percentage of attack.	Date.	Age of crop.	No. of canes.	Weight of canes.	
									Months.		lbs.	
Feb.	18—2—38	64·0	5—4—38	1522	914	608	40·0	31—3—39	13½	465	541	.
March	18—3—38	53·3	21—4—38	449	114	335	74·6	7—5—39	14	160	169	Canes thin and short.
April	15—4—38	64·4	12—5—38	576	100	476	82·6	7—5—39	13	330	690	Canes thin and tall.
May	16—5—38	33·3	16—6—38	289	106	183	63·6	28—7—39	14½	250	952	,, well grown.
June	16—6—38	73·2	28—7—38	1711	1227	484	28·2	15—8—39	14	760	2688	Very good growth.
July	14—7—38	62·4	18—8—38	1012	850	162	16·0	15—8—39	13	826	2940	,,
August	18—8—38	82·5	15—9—38	1630	1384	246	15·0	29—9—39	13½	767	2268	,,
Sep.	14—9—38	61·0	27-10—38	853	759	94	11·0	31-10—39	13½	804	2352	,,
Octr.	14-10—38	30·4	24-11—38	428	421	7	1·6	21-11—39	13	455	1260	Stunted and bushy.
Novr.	17-11—38	48·1	29-12—38	511	500	11	2·1	21-11—49	12	515	1460	,,

TABLE II. Egg-Deposition Data.

Planting month.	Date of		Egg-Deposition.		Parasitisation.		Hatching.		Eggs lost & Damaged.		Remarks.
	First Examination.	Last Examination.	No. of Masses.	No. of eggs.	No. of eggs.	Percentage.	No. of eggs.	Percentage.	No. of eggs.	Percentage.	
February	8—3—38	28—4—38	33	1352	378	27·9	822	60·8	152	11·2	
March	5—4—38	26—5—38	119	5311	3151	59·3	1018	19·1	1142	21·5	
April	5—5—38	30—6—38	197	8392	5643	67·2	582	6·9	2167	25·8	
May	2—6—38	28—7—38	36	2007	907	45·1	765	38·1	335	16·6	
June	7—7—38	25—8—38	80	3127	736	23·5	1449	46·3	942	30·1	
July	4—8—38	22—9—38	13	441	104	23·5	155	35·1	182	41·2	
August	1—9—38	3-11—38	5	136	17	12·5	75	55·1	44	32·3	
September	6-10—38	1-12—38	6	219	81	37·0	138	63·0	...	...	
October	3-11—38	29-12—38	4	166	78	47·0	57	34·3	31	18·6	
November	8-12—38	26—1—39	1	18	18	100·0	...	...	...	...	

TABLE III. Showing rate of Argyria Egg-deposition.

Sub plot planted in	No. of eggs laid during: I period.	No. of eggs laid during: II period.	No. of eggs noticed: on this plot	No. of eggs noticed: on next month's plot	No. of eggs noticed: on (date)	Remarks.
February	1028	324	73	80	5—4—38	The dates are those on which the second period of observation for the concerned plots commenced.
March	2911	2400	433	1478	5—5—38	
April	7616	776	214	179	2—6—38	
May	1763	244	117	1007	7—7—38	
June	2786	341	241	174	4—8—38	
July	381	60	...	...	1—9—38	
August	44	92	92	42	6-10—38	
September	135	84	84	...	3-11—38	
October	142	24	...	18	8-12—38	
November	18	0	...	...	...	

(b) *Egg-parasitism.* The percentage of natural egg-parasitisation (by *Trichogramma)* like the egg-deposition rate, was highest in May but registered a sharp fall from July onwards; the total absence of parasitism in September and cent percent parasitism in December may be left out of consideration as being abnormal due to poor egg-laying registered in those months. This decline in the activity of the egg parasite coincides with the season of rain and heavy wind in this tract,—factors which are likely to operate unfavourably against a fragile parasite like *Trichogramma.*

TABLE IV. Showing the monthly percentages of Egg-parasitisation (a) in general and (b) in the experimental area.

Month	General collection: Number of eggs	General collection: Percentage	Experimental area: Number of eggs	Experimental area: Percentage	Remarks
March	4107	23·5	1028	15·3	
April	4967	48·3	3235	51·4	
May	6191	43·4	10,016	64·6	
June	2433	17·9	2574	65·4	
July	5233	19 8	2995	25·2	
August	4973	27·6	772	25·4	
September	5402	35·2	104	...	
October	3372	22·8	227	26·0	
November	2637	63·8	226	41·1	
December	3072	28·6	42	100·0	

During the entire period of this work a separate monthly record of egg-parasitism was maintained by collecting a number of *Argyria* egg masses from different parts of the tract every week, and working out the percentage of parasitisation from this material for each month. These monthly percentages are given below along with corresponding figures from the experimental area. It will be noticed that there is a rough similarity between the two sets of figures except those for June, September and December. The difference in September and December may be ascribed to the small number

of eggs laid in those months in the experimental plot, but, as regards June it may be presumed that sufficient host material (*Argyria* eggs) was available in a compact nearby plot in the experimental area, to induce an exceptionally high percentage of parasitisation. These exceptions apart, there is sufficient resemblance between the two sets of figures to warrant the assumption that the figures from the experimental area represent the normal seasonal fluctuations of the parasite.

(a) *Hatching and attack.* The number of dead hearts caused by the entry of *Argyria* larvae was much less than the number of larvae that actually hatched out; on the total it was about half (total number of hearts; 2,575 and total number of larvae hatching out 5,061). It is obvious, therefore, that initial larval mortality (i. e., prior to actual penetration) is fairly high, especially as successful larvae are liable to damage more than one shoot each. Further, initial larval mortality appears to be proportionate to the number of larvae hatching out, or in other words, the larger the number of larvae hatching out, the smaller, *proportionately*, the number of shoots attacked. Thus in the plots planted from February to June 4,636 larvae hatched out and only 2,086 deadhearts appeared, while in the plots planted from July to November 425 larvae hatched out and 489 dead hearts were counted. Probably the lack of a sufficient number of young shoots suited for boring into, might be one of the reasons for heavy larval mortality during the period February to June; thus, for 4,636 larvae that hatched out there were only 4,547 shoots (including tillers) available, while in the latter period (July to November) 4,434 shoots were available for only 425 larvae to bore into.

Although stray dead hearts were noticed in every plot from even the first week of examination, a sudden and conspicuous increase in their number was observed somewhere about the 6th week after planting; obviously this stage marks the beginning of real borer attack on the crop. Incidentally the first batch of larvae to hatch out in the plot had done so a fortnight earlier (see following table) and allowing them this interval for dispersal and entry into the shoot as described by Subramaniam and Ramiah (i) it may be persumed that they were responsible for initiating attack. The peak of attack was reached round about the 8th week after planting and in the next 2 or 3 weeks dead hearts were seen in such numbers as to constitute a serious attack. Subsequently, with the appearance of tillers and the crop reaching the age of final earthing up a marked fall in the percentage of attack followed, showing that the age of vulnerability for *Argyria* attack had passed.

(d) *Attack and tonnage.* It is not possible to correlate directly the percentage of borer attack with the tonnage of cane harvested owing to the long period of growth (nearly a year) occurring after the severity of borer attack ends and during which the crop is able to recover from the set-back imposed on it by the pest. Besides other variable factors like cultivation factors (including manuring) and the effect of Top Borer (*Scirpophaga* spp.)

infestation also affect the tonnage. But it is evident from general observation and a study of data presented in this paper, that *Argyria* attack, especially when serious, not only causes a temporary set-back in the initial stages (involving delay and extra expenditure) but also affects the tonnage adversely. Thus the weight of cane harvested from sub-plots planted from February to May (see table I) which suffered from a serious infestation was much less than that obtained from sub-plots planted in the subsequent months. Generally, a bad infestation confers a patchy appearance on the crop which is not erased to the last and which results in an unequal stand of cane and consequent loss of tonnage; repeated attack on a stool turns it into a busy growth from which no millable canes are obtained at harvest. Again it is common experience that "B" season (July to November) planting with little or no borer attack on it yields a higher tonnage in this area than the "A" season cane (planted from February to June) which is normally subject to severe attack. While seasonal conditions and other factors have their own share in it, it is apparent that the severity or otherwise of borer attack is one of the factors responsible for this difference in tonnage between the two planting seasons.

TABLE V. Showing the course of Argyria attack.

Planting.	Attack began in	Percentage.	Peak of attraction.	Percentage.	First batch of larvae hatch out in.
February	7th week	31·5	8th week	42·1	5th week
March	6th „	61·0	9th „	75·0	4th „
April	5th „	34·4	9th „	84·4	3rd „
May	6th „	43·4	8th „	69·3	4th „
June	6th „	20·4	10th „	28·2	4th „
July	6th „	12·7	8th „	25 6	4th „
August	6th „	15 8	7th „	16·7	8th „
September	6th „	6·0	9th „	10·3	4th „
October	6th „	3·9	7th „	4·0	7th „
November	7th „	1·4	10th „	2·1	...

Summary. This work was undertaken with the object of obtaining data concerning the egg-deposition rate and the percentage of egg-parasitisation of *Argyria sticticraspis Hmp.*, the sugarcane stem borer, under natural conditions. A plot of land $\frac{1}{4}$ acre in extent was divided into ten equal sub-plots which were planted, one every month from February to November 1938. No borer control measures were adopted.

Weekly observations were made on each sub-plot from the 3rd to 12th week after planting; every plant was searched for *Argyria* egg-masses, and when one was located, the number of eggs in it and its condition (whether fresh laid, parasitised, hatched or damaged) was immediately recorded. Fresh-laid eggs were marked for examination during the subsequent week.

The percentage of attack was calculated from the number of dead hearts and healthy seedlings counted separately. Dead hearts were not removed.

The percentage of germination wss also worked out. The harvesting was attended to in due course in 1939.

Argyria egg-laying reached its peak in May and was negligible in December. The crop in the first month after germination appeared to be more attractive for oviposition than in the second month.

The percentage of egg-parasitisation by *Trichogramma* was highest in May but declined sharply from July onwards probably due to rain and heavy wind. There was a fairly close similarity between the monthly percentages of egg-parasitisation derived from the experimental plot and from general collections.

The rate of initial larval mortality was apparently fairly high, especially in the "A" season, probably due to an insufficient number of shoots available for boring into. Actual attack began round about the 6th week after planting and could be traced to the first batch of larvae hatching in the plot a fortnight earlier. The peak of attack was attained in about the 8th week after planting.

No direct correlation between percentage of attack and tonnage at harvest was found, as the crop had nearly a year to recover from the effect of borer attack, but the weight of cane harvested from the sub-plots planted from February to May (which suffered from severe attack) was much less than that obtained from the later planted sub-plots.

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EXTRACT

The Production of High Vitamin A Milk by Diet. H. J. Deuel, Jr., Nellie Halliday, Lois F. Hallman, Cornelia Jonston and Albert J. Miller. The vitamin A content of the butterfat obtained from cows on a diet high in fresh alfalfa was coniderably increased by the administration of shark liver oil in daily doses of approximately 700,000 I. U. although lower amounts were ineffective.

The vitamin A in butterfat averaged 113 I. U. after administration of the vitamin A supplement at a level of 1,400,000 I. U. daily. In one cow, the level reached 170 I. U. per gram which value was also noted a month later. The increased amounts of vitamin A in the butters persisted without diminution over a five month period during which the experiments were continued.

There is a marked decrease in carotene which occurs even when doses of shark liver oil, too small to cause an increase in the level of vitamin A in milk are fed.

No toxic symptoms were noted and the cows remained in good nutritional conditions as reflected by the increased production of milk and butterfat.

The present experiments emphasize the lack of correlation between color of the milk and its vitamin A content. —The *Jour. Nutrition*. 22(3) September 1941.

Cotton Stem Weevil. In parts of Madras, where Cambodia cotton is grown over large areas, healthy plants wither away all of a sudden due to the damage caused by the cotton stem weevil. In seasons of severe incidence, the loss by death of plants may be as high as 25 per cent. To overcome the ravages caused by this pest the Indian Central Cotton Committee is financing a scheme, the object of which is to devise effective control measures based on the study of the life history, habits and bionomics of the insect, the nature of the plant's resistance to weevil infestation and the efficacy of the biological methods in checking the spread of the pest.

Problem of control. The association of the pest and the host has been found to commence from the time the egg is laid by the adult insect in a small cavity made for the purpose in the cooler region of the stem just above the ground level. The most critical period in the relationship between the host and the pest is when the insect cuts out a ring of the functioning tissue around the woody region during its travels inside the stem in search of food. The injury thus caused generally results in the death of the plant. After a period of active burrowing inside the stem, the larva pupates in a chamber excavated in the core of the stem and finally emerges as an adult insect through a previously made passage. The insect borer thus completes its life-history, from the egg to the adult stage, inside the stem and thus presents one of the most difficult problems in the field of insect control.

The attacked plants which survive to the end of the season escape death either by the exudation and formation in the larval gallery of wound gum which entombs the larva or by proliferation of tissues and development of one or more galls at the attacked part of the stem which prevents their lodging, or by both these means.

The weevil appears to attack all cottons, exotic and indigenous, and no variety, cultivated or wild, has so far been found to be immune to its infestation. Nadam cotton amongst the Asiatic and Bourbon and three Brazilian varieties, viz. Quebradinho, Verdao and Moco, amongst the New World cottons have, however, proved to be highly resistant. The nature of resistance in the case of Nadam and Bourbon cottons is mainly by rapid proliferation of tissues, while in the three Brazilian varieties the resistance is due to ready exudation of gum into the larval gallery.

It has been found that the weevil passes through three generations during the cotton season—September to March—at Coimbatore. In addition to cotton, it infests a large number of alternative host plants such as *bhendi*, hollyhock and several wild plants and weeds. The presence of a large number of such host plants near the cotton areas seems to preclude the effective enforcement of a close period to starve out the pest.

Attempts to control the stem weevil by means of its natural enemies have not so far yielded any successful results, while the pempheres larvae are parasitized by 15 or 16 different parasites the maximum percentage of total parasitism is very low, ranging from 0·2 to 5·2 per cent.

Promising hybrids. Gum formation appears to occur earlier and quicker in the Brazilian varieties than in Cambodia, on account of changes in the water soluble polysaccharides of the plants, but the relationship between resistance and the amount of polysaccharides present has not been found to be significant.

The local Camboida strain, Co. 2, has been found to be highly susceptible to attack, and attempts are being made to evolve a strain which is resistant. Notwithstanding their high degree of resistance, Brazilian varieties referred to above cannot be introduced in the tract, as all of them are perennial, late maturing, poor ginners, susceptible to jassids and defective as regards boll opening. Amongst the different hybrid populations under trial the progenies of Moco x Co. 2 cross have been found to be most promising in respect of resistance. As a result of comparison of the progenies of Moco x Co. 2 two cultures 7,176 and 7,178, which have shown low proportion of mortality and adult emergence, have been isolated. In order to introduce vigour and early maturity, they have been crossed with the newly evolved strains from Co. 2 x Uganda crosses. Trials are now under way to isolate resistant strains which are at the same time early maturing and superior to the local in economic characters. The criterion of selection is nil mortality and nil adult emergence; in other words, a plant which quickly floods all the burrows with gum and entombs the larvae. Special precautions are taken to create uniform incidence of the pest at all points of the field and to increase the intensity of infestation by spreading infested stems containing fully grown larvae and pupae, so that the resistant types may be spotted easily. *Indian Farming*, 2 (11), November, 1941.

Restaurant Straws. Paper straws for sipping fruit juices and cold drinks are usually imported from the United States of America and some European countries. But owing to war their import is more or less cut off. Most of the restaurants, milk-bars and soda fountains may be finding it difficult to offer straws with their drinks. I would suggest the use of wheat straws instead of the usual paper ones.

The straws can perferably be gathered from the standing wheat crop. Arrangements could be made with cultivators who will be prepared to sell a portion of their crop at nominal cost after, of course, taking off the ear-heads. Suitable straws can also be selected from the undamaged harvested bundles of wheat. The straws could be cut into suitable size and sterilized. The most usual size for a straw is about nine inches.

The golden yellow colour of the straw makes it attractive and provided undiseased and uniform straws are selected, I am sure, the majority of users will really appreciate them. *Indian Farming* 2, (11), November, 1941.

Indian Canes Abroad. The sugarcanes Co. 419 and Co. 421 bred at the Imperial Sugarcane Station, Coimbatore, have done so well in several tracts in India that their performance at certain places outside India is not without interest. Two such reports on Co. 419 and one on Co. 421 are now available.

In Trinidad (Field Experiments on Sugarcane, Annual Report for 1940) the yields of Co. 419 and Co. 421 were 59·20 and 49·59 tons per acre, respectively, as against 48·78 tons from F. C. 916. 41·00 from B. H. 10 (12), 39·32 from Co. 313, 29·60 from C. P. 28/11 and 28·47 tons from C. P. 28/19. Co. 419 thus gave a significantly larger yield of cane than any of the other varieties. Co. 421 and F. C. 916 were significantly superior to B. H. 10 (12), which was in its turn significantly superior to only C. P. 28/11 and C. P. 28/19.

In the same report another experiment with the varieties Co. 421, Co. 419, Co, 213, Co. 290 and Uba is mentioned. The yield of cane per acre was 45·48, 41·78, 39·06, 30·10, 31·54 tons, respectively. Co. 421 thus gave a significantly larger

yield than any other variety. Co. 421 also gave plant cane of much higher quality than any other variety as the figures for tons of cane per ton of sugar were 7·76, 8·30, 8·92, 8·40 and 9·30 respectively. As a consequence of this. Co. 421 gave by far the largest yield of plant sugar. The actual figures for tons of sugar per acre were 5·87. 5·03, 4·38, 3 58 and 3·39 respectively.

In British Guiana (Sugar Bulletin No. 9, 1940) Co. 419 was tried along with four other varieties and gave a yield of 50·19 tons of cane per acre. The other varieties were POJ, 2,878 Co. 290, D. 32/35, D. 361/35 and yielded 41·35, 40·99, 31·89, and 26·86 tons of cane per acre respectively. The report adds, 'The recently introduced Co. 419 was outstanding, especially as regards tonnage. If it maintains the promise it has shown here and in the nurseries at Sophia, this cane is likely to be of considerable service'.

The above mentioned good performance of the Coimbatore-bred canes in the home of the famous Barbados and Demerara canes is noteworthy. It may be recalled that the British West Indies were among the very first, the other being Java, to improve their industry by the breeding of new varieties. Demerara also was one of the early centres of production of new varieties. If the Co. canes keep up to their early promise in Trinidad and British Guiana, they will afford yet another instance of the service of Coimbatore to the countries of the British Empire. *Indian Farming*, 2 (11), November, 1941.

Groundnut as a Human Food. Groundnut (*Arachis hypogaea* Linn.) is really a leguminous plant, although in their chemical composition groundnuts resemble nuts such as cashew, almond and walnut more closely than they resemble pulses. The plant is a native of Brazil, from whence it spread to Africa and Asia. It has been cultivated in the tropics and sub tropics for several centuries, and in India groundnut is an important crop. It is grown chiefly in Madras, but Bombay and the Central Provinces are also important centres of production. In normal times groundnut oil and cake are exported in large quantities to the United Kingdom and the continent of Europe. As a result of the war, exports from the Madras province dropped from 760,000 tons in 1938–39 to 282,000 tons in 1940–41.

The reduction of the export trade has produced a disposal problem. One method of disposal would be its wider use as human food and this raises the question of its nutritive value. Per 100 grammes, it contains about 25 to 33 grammes of protein, 40 to 50 grammes of fat and 10 to 20 grammes of carbohydrate. It is rich in phosphorus, but not in calcium. As regards its vitamin content, it contains some of the B vitamins, notably B_1 and an important member of the B_2 group, nicotinic acid, in fair amounts, but no vitamin A. Groundnut oil, like most vegetable oils, is devoid of this valuable constituent. *Vanaspati* or vegetable ghee, which is usually made from groundnut oil, does not contain fat soluable vitamins A and D.

Experiments with groundnut. In the Coonoor Laboratories a long series of experiments have been carried out on the value of various foods in 'supplementing' poor rice diets. Rats are given a diet which resembles in composition poor rice diets eaten by human beings. Different foods are added to this basal diet and their effect on the development of the rats observed. This method of testing provides a good idea of their nutritive value under Indian conditions—in fact it is in some ways a better index than detailed chemical analysis. If milk is added to the rice diet, the result is a striking increase in the growth rate and an improvement in the general condition of the animals. Groundnut, however, when given in amounts equivalent to 1 to 2 oz. daily in a human diet does not produce any striking supplementary effect. The conclusion is that groundnut, although it is rich in certain food factors, does not contain enough of the constituents which are most needed by the poor rice eater to make good the defects of

his diet. Milk, on the other hand, contains these in the correct proportions It is possible that the relatively low calcium content of groundnut is to some extent responsible for its failure as a supplement and its deficiency in certain vitamins in the B_2 group may also be concerned Experiments on this subject are proceeding.

Suppose half to one ounce of groundnut were distributed daily to poor children in schools. It is not to be expected that such a supplement would be as effective in improving their state of nutrition as a glass of milk. On the other hand groundnut taken in small quantities, is perfectly good food. Its high fat content makes it a concentrated food, with a high caloric yield per unit of weight. Since many poor school children are under, as well as, mal-nourished, any supplement which increased their total food intake would be of value. In normal times peanuts sold very cheaply in small paper bags are very popular among poor children in London.

Groundnuts as such have never been used as staple human food anywhere in the world. Consumed in large quantities they tend to be nauseating, probably because of their high fat content. Their main use has always been as a source of oil, the 'cake' which remains after the extraction of oil being employed as cattle food and manure. It is said that groundnut cake is used as human food in Spain. In U. S. A. so called 'peanut butter' has been fairly widely consumed, and in that country roasted peanuts are very popular. The inclusion of groundnut flour in small quantities in wheaten biscuits has been suggested.

The idea that groundnuts could be used in India as an important article of diet, replacing equivalent quantities of cereals such as rice may be dismissed. They could, however, be consumed in somewhat greater quantities as an addition to ordinary diets, either in the form of roasted nuts or as a sweetmeat with jaggery. Even a slight increase in consumption would help to dispose of surplus stocks. In the present circumstances it is unfortunate that they cannot be strongly recommended by the nutrition worker as an exceptionally valuable food, but there is no reason why their use as human food should not be extended (Note issued by the Nutrition Research Laboratories, I. R. F. A., Coonoor) *Indian Farming*, 2, (11), November, 1941.

Gleanings.

Coconut Shell and Husk Ash. In view of the shortage and uncertainty of supplies of potash fertilizers several coconut estates are preparing both shell ash and husk ash, which are rich in potash and command a price of 3 $ per ton for 1 per cent. of potash, calculated as K_2O. The potash contents of the ash the shell and the husk are about 52 and 44 per cent., equivalent to returns of 156 $ and 132 $ per ton respectively.

Figures for the ash content of shell and husk are 0·7 and 2 8 per cent. while the proportions of shell and husk in the freshly-gathered nuts are 16·5 and 31·7 per cent. respectively. Thus, the husk is a much richer source of supply of potash than the shell.

To produce 1 ton of husk ash approximately 639,600 nuts are required; the shells would yield an additional 282 lb. of ash. The financial returns would be 132 $ for the husk ash and about 20 $ from the shell ash.

If shells alone are burnt nearly 510,000 nuts are required for 1 ton of ash.

Further details will be given in the November issue of the Journal. (*Malayan Agricultural Journal*) (29 (10) October, 1941.)

Food from the Air. Nitrogen from the air, in addition to being the main source of explosives, enters extensively into fertilisers and into the manufacture of a group of compounds known as plastics. Now as the result of brilliant research work, chiefly at the Agricultural College of the University of Wisconsin, it is used to replace protein in cattle feeds. Urea is not a protein, it is a compound of ammonia and carbon dioxide, but in ruminant animals it is converted to protein. The rumen teems with billions of microscopic plants—mostly bacteria, some of which seize upon non protein nitrogen and break it down to ammonia which in turn is used by others to make protein. Animals, unlike plants, have themselves no mechanism for synthesising protein.

Up to three pounds of urea can be used to a hundred pounds of grain concentrate, with which it must be well mixed. Above that rate harmful results are likely.

In great Britain where the importation of protein concentrate has been seriously restricted, the use of urea, if it can be spared from munitions, is likely to bring relief to the sorely tried farmers. *(Rhod. Agri. Jour.* 38 (4) April 1941.)

Kikuyu. Two articles on Kikuyu grass (*Pennisetum clandestinum*) appear in the New Zealand Journal of Agriculture for November. The grass, which is a native of Kenya was, according to P. S. Syme, introduced into New Zealand about 1919, and in Auckland Province at all events, is no longer welcome. On loose fertile soil Kikuyu spreads with alarming rapidity and once firmly established is very difficult to eradicate. It has been found in New Zealand that Kikuyu introduced to a rye-clover sward quickly suppressed the clover, and then lacking nitrogen, itself formed a stemmy sod-bound mat of runners of inferior feeding value. Joints of the runners were moved by the feet of cows to other fertile lands and spread with devastating rapidity, choking out clovers, and ruining the existing pasture. The grass, according, to the same writer, requires a very fertile or loose soil for its best growth. In respect of its growth on loose soil and its drought resisting qualities, both he and J. E. Bell, in another article, find much to commend Kikuyu, which was found to have a very definite value for covering slips, checking erosion on hill country, and in binding sand dunes. On land which is not agricultural, on sandy wastes which are threatening to drift and cover good agricultural land, Kikuyu has proved of the very greatest value, in conjunction with marram grass and lupinus. (*Rhod Agri. Jour.* 38, (2. February 1941.)

Kudzu. The kudzu*, which was fully described in the July issue of the Journal, is assuming growing importance in Australia although according to the Queensland Agricultural Journal, not very extensive trials have been made. American experience is entirely in its favour. Since the beginning of erosion control in America, 40,000 acres have been planted with this crop mostly in the South Eastern States. Everywhere it has earned a high reputation as a fodder crop and as a soil binder.

It is not seriously affected by drought, it grows rapidly, it restores fertility to the soil by adding nitrogen and organic matter, and it maintains a stand over long periods without yearly soil preparation and planting. It grows vigorously on eroded land when once established, and its dense cover protects the soil from beating rain. Not only is kudzu specially suited for the reclamation of badly eroded slopes, but it also produces a palatable hay and forage of excellent quality with a high feeding value. *(Rhod Agri. Jour.* 38, (2) February 1941).

Bee Venom Destroys Alcohol Poison. "Referring to alcohol and bee venom it is a well known fact that although they are chemically antagonistic, with regard

* *Pueraria thunbergiana.*

to physiological effects they are stimulants. Alcohol chemically destroys bee venom and the reverse. Because the alcoholics resort to alcoholic liquor for the stimulating effect it stands to reason that beekeepers being often stung by bees and being thus stimulated they do not need the stimulating effect of alcohol. That is the reason beekeepers, as a rule, are water drinkers. Dr. Bodog F. Beck. (*Indian Bee Journal*, March and April 1941)

Honey as Baby Food. A neighbour of mine had a baby girl, perfectly normal in every way at birth, but who lost weight and cried continuously because of hunger. The mother could not feed her, and no commercial preparation seemed to agree with her, cow's milk included. At six weeks of age she weighed less than at birth.

I was worried, as I had been with the mother when the baby was born, and I was sure she would lose it, if something were not done soon. I took her some of our honey, and asked her to try a teaspoonful of it in a bottle of cow's milk instead of sugar.

It was miraculous. The baby took it greedily, did not vomit, and slept several hours. From then on she began to gain. She is now three years old and the picture of Health. Mrs. Howard C. Coale. (*The Indian Bee Journal*, March and April 41.)

Soil Conservation. Control of soil erosion is being placed on a thoroughly scientific basis for the first time in the world's history, was pointed out by Dr. Hugh Bennet, chief of the U. S. Soil Conservation Service, in an address given at the meeting of the American Association for the Advancement of Science. The ancient world developed some remarkable engineering works designed to stabilize hill side soil, but not until the American soil conservation program got under way, was there a convergence of such a diverse array of knowledge and skill as now puts up a defensive battle against erosion. Any given project will call for the services of crop experts, engineers, foresters and possibly other types of scientific workers. Before actual work is started on a farm or group of farms, a thorough survey is made. Each field is classified according to soil type, slope, extent of erosion and land use. Maps based on such surveys guide farmers in the more advantageous and economic use of their land. Already 90 million acres have been thus surveyed. Particular attention has been given to the problem of producing crop without constantly turning the soil over and thus exposing it to accelerated erosion. The Soil Conservation Service has developed a technique known as "stubble mulching." Crop residues are left on the surface while the soil underneath is ploughed with a subsoil tiller. The residues thus provide surface protection which checks runoff by keeping the surface soil in such condition that nearly all the water soaks into the ground. This reduces evaporation from the surface and helps protect the land against both wind and water erosion. (*Science* Vol. 94; No. 2429, Suppl, July 1941.)

Correspondence.

To

The Editor, The Madras Agricultural Journal.

Sir,

Measurements of an extraordinary Indian bee colony. In August 1940 a colony of the Indian bee *(Apis indica)* of unusual size was observed attached to the ceiling of a house in Muddapura village of Tadepallegudem Taluk. The age of the colony was about 9 to 10 months. In September 1940, the colony was hived in a standard Newton hive. Only a single queen was found in the colony. Before hiving rough measurements were taken of the combs. The colony

measured 15″ × 9″ × 8″ and the total surface area of the combs was 1433·3 sq. in. The largest comb measured 18″ × 9″.

At the time of hiving 8 lb. of honey was obtained. The hived colony was shifted to Vundrajavaram village and it gave about 28 lb. of honey from February to October 1941. The colony is now in good working condition.

In a communication to the *Indian Bee Journal* (Vol. III Nos. 5 and 6) by D. N. Vaishnava, measurements of 2 or 3 such colonies are given. One of these measured 18″ × 8″ × 12″ the largest comb in it measuring 19½″ × 7″ (combs were occupying curved positions). Another one measured 17″ × 8″ × 12″ with 13 combs of varying sizes the largest one being 12″ × 7½″.

Kovur
4—9—41

Yours etc.,
A. Sankaram.

We understand that the Government Entomologist, Coimbatore, has come across such big sized colonies on three occasions. (Editor).

Crop and Trade Reports.

Statistics—Paddy—1941-42—Second forecast Report. The average of the areas under Paddy in the Madras Province during the five years ending 1939-40 has represented 13·1 per cent of the total area under paddy in India.

The area sown with paddy upto 25th November 1941 is estimated at 8,737,000 acres. When compared with the area of 8,928,000 acres estimated for the corresponding period of the previous year, it reveals a decrease of 2·1 per cent.

The area is the same as that of last year in Bellary, Anantapur and the Nilgiris. An increase in area is revealed in Guntur, the Carnatic, Coimbatore, Trichinopoly and the South and a decrease in area in the other districts of the Province. The variations are marked in Vizagapatam (–130,000 acres), East Godavari (–70,000 acres), West Godavari (–90,000 acres), Chingleput (Plus 60,000 acres), Salem (–45,000 acres), Trichinopoly (plus 45,000 acres) and Tinnevelly (plus 60,000 acres).

The first crop of paddy has been generally harvested throughout the Province. The yield per acre is expected to be normal in Guntur, Bellary, Anantapur, Nellore, Chingleput, Salem, Madura, Ramnad, Tinnevelly, Malabar and South Kanara and below normal in the other districts of the Province due generally to insufficient rains. Paddy under tanks in the upland taluks of West Godavari and Kistna, samba paddy in Chingleput, and paddy in Salem and Tanjore are reported to have been affected to some extent by insect pests.

The seasonal factor for the province as a whole works out to 97 per cent of the average as against 99 per cent in the corresponding period of the previous year.

The wholesale prices of paddy, second sort, per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 8th December 1941 was Rs. 4—1—0 in Chittoor, Rs. 4—0—0 in Vellore and Madura, Rs. 3—14—0 in Masulipatam, Rs. 3-13-0 in Bezwada and Guntur, Rs. 3-12-0 in Rajamundry, Ellore and Anantapur, Rs. 3-10-0 in Vizianagaram, Cocanada, Hindupur, Virudunagar and Tinnevelly, Rs. 3—8—0 in Trichinopoly, Rs. 3—4—0 in Conjeevaram, Rs 3-3-0 in Kumbakonam, Rs. 3-2-0 in Negapatam, and Rs. 2-15-0 in Cuddalore. When compared with the prices published in the last report, i. e., those which prevailed on 3rd November 1941, the prices reveal a rise of 20 per cent in Anantapur, 16 per cent in Hindupur, 11 per cent in Rajahmundry, ten per cent in Vellore, nine per cent in Bezwada, Guntur and Cuddalore, eight per cent in Chittoor, seven per cent in Ellore and Masulipatam, six per cent in Conjeevaram, five per

cent in Madura, four per cent in Cocanada, and two per cent in Kumbakonam and a fall of about seven per cent in Negapatam and three per cent in Virudunagar, the prices remaining stationary at Vizianagaram, Trichinopoly and Tinnevelly.

Statistics—Crop—Sugarcane—1941—Intermediate condition report. The condition of the sugarcane crop is generally satisfactory and the yield per acre is expected to be generally normal in all districts outside Vizagapatam, East Godavari, Kistna, Kurnool, Bellary and North Arcot. The canes are reported to have lodged in parts of North Arcot on account of the recent cyclone.

The wholesale price of jaggery per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 8th December 1941 was Rs. 5—14—0 in Trichinopoly, Rs. 5—11—0 in Vizagapatam, Rs. 4—15—0 in Rajahmundry and Adoni, Rs. 4—10—0 in Cocanada, Rs. 4—9—0 in Mangalore, Rs. 4—6—0 in Cuddalore and Vellore, Rs. 4—2—0 in Vizianagaram, and Chittoor, Rs. 3—9—0 in Coimbatore, Rs. 3—5—0 in Salem and Rs. 3—3—0 in Bellary: When compared with the prices published in the last report, i. e., those which prevailed on 3rd November 1941, these prices reveal a rise of approximately 34 per cent in Trichinopoly, 20 per cent in Rajahmundry, 14 per cent in Vizagapatam, 12 per cent in Cocanada, nine per cent in Vellore and four per cent in Coimbatore and a fall of approximately 17 per cent in Mangalore, the prices remaining stationary in Vizianagaram, Adoni, Bellary, Cuddalore, Salem and Chittoor. *(From the Director of Industries and Commerce, Madras).*

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 5th December 1941 amount to 610,741 bales of 400 lb. lint as against an estimate of 503,500 bales of the total crop of 1940-41. The receipts in the corresponding period of the previous year were 498,728 bales. 568,262 bales, mainly of pressed cotton were received at spinning mills and 60,631 bales were exported by sea while 1,08,046 bales were imported by sea mainly from Karachi and Bombay.

(From the Director of Agriculture, Madras).

Mofussil News & Notes.

The Agricultural Exhibition held at Mayavaram in November 1941. An Agricultural Exhibition was held for 10 days from the 6th to 16th November 1941 at the bathing ghat of the river Cauvery at Mayavaram during the "Thula Cauvery Punyakalam bathing Festival". A large concourse of people from the different parts of the Tamil Nad, who came down to this place for the occasion, visited the exhibition stall. Daily attendance at the stall was more than 10,000. The exhibits and posters were arranged in groups or sections representing the different phases of the Departmental activities and these included paddy strains classified as *Kuruvai* and *Kar*, *Samba*, deep water and other special varieties both local and foreign strains of millets and oil seeds, timber and fruit plants recommended for the tract; a working colony of bees; implements and specimen crops of green manures, paddy nursery with reduced seed rate and other usual features. Special mention may be made of an arresting pictorial poster on preservation of cattle manure recently printed by the Department and a word poster written up for the occasion calling on the *mirasdars* to use freely the services of Department and to very materially increase the food production of the country to meet deficits which were met in normal times by imports from other countries. Laudable remarks and appreciation of the Departmental efforts were recorded by some of the visitors in the visitors' sheet opened for the purpose, and these included valuable suggestions and indents for implements, seeds and plants also. A large number of departmental publications, including a few priced ones, were distributed among the public. M. A.

Rural uplift work, by the Ryots' Association, Thotavada, Palakonda Taluk, Vizagapatam District. The Ryots' Association was started in 1940 November by the Deputy Director of Agriculture, Cocanada, and conducted rural uplift work from 27—11—1940 to 1—12—40. This year the Association organised rural uplift work from the 14th to the 18th November. Every day there were meetings, and the ryots were advised by the officers of the different Departments of Government as well as by the Medical and the Educational officers of the District Board on various subjects. The meetings were attended by members of the District Board and Panchayat Boards, and a large number of *ryots*.

The items of work consisted of laying improved roads, cleaning of villages and water sources, attending to the ailments of cattle, exhibitions of improvements recommended by the Agricultural, Veterinary, Public Health and Education Departments, with lantern lectures and entertainments of the visitors by *bhajanas* and dramas. Use of improved agricultural implements, bee keeping, spinning with charkhas mat making and rope making were also demonstrated. Fruits, trees and useful plants such as, *bodantam* (*Bauhinia purpurea*, Linn.) were planted in the *porambokes* and school gardens were started. B. P.

College and Estate News.

Students' Corner. Students' Club:. There was a lecture by Rev. J. C. McGilvray, M. A. (Oxon) on "The background for the war news that we receive through various sources like the papers, radio, etc" on Monday, the 24th November. Sri A. Adivi Reddy, B. Sc. III occupied the chair. The lecture was most interesting as it revealed certain startling facts about the German preparation for world conquest. The members of the Students' Club had a lucky opportunity to listen to a most illuminating and exhilarating address by Sri. Rao Bahadur O. Kandaswami Chettiar, retired Professor of English of the Madras Christian College, on Monday, the 1st December on "Four things that an aspiring young man should possess". Sri. S. N. Chandrasekhara Ayyar, Lecturer in Botany and an old student of the Professor, presided. Rev. J. C. McGilvray again spoke to the members of the club on the 8th of December on "The British and Indian Universities". R. C. Broadfoot Esq., I. A. S., Principal of the College, Presided.

Cricket. In the match for the Rhondy shield played on 29—11—41, on our grounds, between the Agricultural College and the Government Arts College, Coimbatore, our College won by scoring 143 for 5. The opponents were all out for 128. A remarkable feature of the match was the brilliant batting of H. Shiva Rau, who scored 41, and C. Sankara Rao who remained unbeaten with 57.

Football. In the match for the Stone Trophy Tournament, played on the 25th November our College was defeated by the Government Arts College, Coimbatore, by 2 goals to nil.

Interclass tournaments for the Victory Cup:—

Cricket. 8—11—41 class III defeated class II.
Hockey. 27—11—41 class I defeated class II.
Football. 16—11—41 class II defeated class I (finals).

Inter-tutorial tournaments.

Cricket. 9-11-41. C. Narasimha Ayyangar's wards defeated P. V. Ramiah's wards.
15-11-41. C. M. John's wards defeated B. M. Lakshmipathi's wards.
16-11-41. C. R. Srinivasa Ayyangar's wards defeated C. Narasimha Ayyangar's wards.
22-11-41. K. M. Thomas's wards defeated C. M. John's wards.

Hockey. 9-11-41. B. M. Lakshmipathi's wards defeated C. R. Srinivasa Ayyangar's wards.

30-11-41. B. M. Lakshmipathi's wards defeated C. M. John's wards.

Football. 30-11-41. P. V. Ramiah's wards defeated C. R. Srinivasa Ayyangar's wards.

Association of Economic Biologists Dr. S. Ramanujam delivered a lecture on 'Self Sterility in Plants' on 21st November 1941, under the auspices of the association.

Ladies' Club. The Annual Club Day was celebrated on 6th December with great eclat. The premises of the club was tastefully decorated and a number of interesting items of sports were gone through. In the evening, there was an entertainment. Mrs. V. Ramanathan distributed the prizes.

Table Tennis tournaments. We are glad to learn that Sri. N. Muthuswami Naidu of the Entomology section has been chosen as one of the five to represent Madras in the Inter-Provincial Table Tennis tournaments to be held at Delhi this Christmas. We offer our hearty congratulation to Sri. N. M. Naidu, and wish him all success.

St. John Ambulance Brigade. Another Examination in First Aid was held on 17th November 1941 at which 28 students and two members of the staff of the Agricultural College and Research Institute appeared. Twenty seven came out successful. So far, 87 people from the college estate have secured the First Aid certificates.

University of Madras. The Maharaja of Travancore Curzon Endowment lectures—Agriculture—1942. Under the above endowment Dr. A. Subba Rao, M. A., M. Sc., D. Sc., F. Inst. P., Soil Physicist, D. F. S. Bellary, delivered two lectures on :"Soil erosion and conservation of moisture in the un-irrigated black soils," on the 18th and 19th December 1941, at the Agricultural College, Coimbatore.

Senate Elections. We understand that Sri. S. N. Chandrasekaran, Lecturer in Botany, Agricultural College and Research Institute, Coimbatore, intends standing as a candidate for election to the Senate of the University of Madras by the Registered Graduates, at the ensuing elections to the Senate. Mr. Sekhar has put in over twenty-two years of service as Lecturer in the Agricultural College and is eminently fitted to represent Agricultural education in the Senate. He has been taking keen interest in educational matters and has served in the Academic council during the years 1938 to 1940 as the unanimously elected representative of the teaching staff of the Agricultural College. We heartily commend his candidature for general acceptance and specially request the members of the Union and the readers of the Madras Agricultural Journal to give their first vote in his favour.

Departmental Notifications.

Gazetted Notifications.

Appointment.

Sri. C. R. Srinivasa Ayyangar, the senior-most Crop Specialist is appointed Paddy Specialist and Geneticist during the absence on leave of Sri. Rao Bahadur G. N. Rangaswami Ayyangar.

Sri. C. Vijayaraghavacharya, permanent Upper Subordinate, Science section and temporary Superintendent, Dry Farming Station, Hagari, on leave is recalled and appointed to officiate as Millets Specialist, Coimbatore, vice Sri. Rao Bahadur G. N. Rangaswami Ayyangar granted leave.

Postings

Sri. M. U. Vellodi, District Agricultural Officer, on return from leave to be District Agricultural Officer, Coimbatore,

Sri. R. Swami Rao, District Agricultural Officer, on return from leave to be District Agricultural Officer, Guntur.

Sri. N. Subramania Ayyar, Officiating District Agricultural Officer, on relief by Sri. M. U. Vellodi, is posted as District Agricultural Officer, Sattur *vice* Sri. K. Avudainayagam Pillai, on leave.

Leave.

Sri. Rao Bahadur G. N. Rangaswami Ayyangar, Millets Specialist and Geneticist, Coimbatore, is granted l. a. p. for one month with effect from 12-12-1941 afternoon or date of relief.

Sri. V. T. Subbiah Mudaliar, D. A. O. extension of l. a. p. for 2 months from 3-1-42.

Sri. S. Sitharama Pathrudu, D. A. O. extension of l. a. p. for 1 month from 11-12-41.

Sri. R. Chockalingam Pillai, D. A. O., Salem, l. a. p. for 1 month and half average pay for 6 months from 10-1-42.

Sri. K. Avudainayagam Pillai, D. A. O., Sattur, l. a. p. for 4 months from date of relief.

Subordinate Service.

Appointments.

Syed Ibrahim Sahib is re-appointed as Upper Subordinate, Science Section and is posted to officiate as Assistant in Chemistry, Agricultural Research Station, Siruguppa.

Mohammed Zainulabdeen Sahib, Officiating Upper Subordinate, is re-appointed as Upper Subordinate in the Science section and is posted to officiate as Assistant in Paddy, Agricultural Research Station, Maruteru.

Transfers.

Name of Officers.	From	To
Sri. V. V. S. Varadarajan,	F. M., A. R. S., Guntur,	A. D., Ongole.
,, N. Ramadoss Pantulu,	A. D., Ongole,	F. M., A. R. S., Nandyal.
,, T. Paramanandam,	F. M., A. R. S., Nandyal,	F. M., A. R. S., Guntur.
,, K. M. Narayanan,	F. M.. A. R. S., Nileshwar,	F. M., A. R. S., Nanjanad.
,, K. Jagannatha Rao,	D. A. O., Guntur,	A. D. Badvel.
,, V. Karunakaran Nayar,	F. M., Agri. Coll. Dairy, Coimbatore.	A. D., Sivaganga.
,, A. K. Annaswamy Ayyar,	A. D., Sivaganga,	F. M. Central Farm, Coimbatore.
,, K. Brahmachari,	Temporary Asst. in Entomology A. R. S. Gudiyattam,	Asst. in Entomology, Coimbatore.
,, M. Narasimham,	A. D., Tenali,	F. M., A. R. S., Samalkota.

Leave.

Name of Officers.	Period of Leave.
Sri. S. Ramachandran, A. D. (on leave)	Extension of l. a. p. for 3 months from 5—11—41.
" C. Ekambaram, F. M., S. R. S., Gudiyattam,	L. a, p, on m. c. for 35 days from 19—11—41,
" A. Venkobachari, A. D., Harpanahalli,	Leave on half average pay on m. c. for 4 months from 5—11—41.
" P. K. Kannan Nambiar, F. M. (on leave),	L. a. p. for 2 months from 28—11—41.
" M. Satyanarayana, F. M., A. R. S., Samalkota,	L. a. p. for 3 months and 22 days from 2nd January 1942.
" P. K. Natesa Iyer, A. D., Rasipuram,	L. a. p. for 6 weeks from 19—12—41.

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